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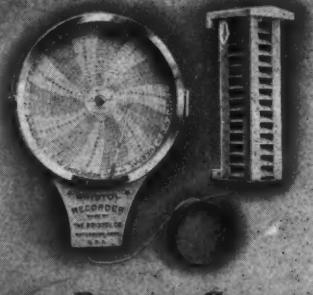
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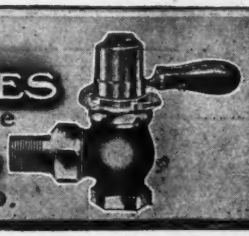

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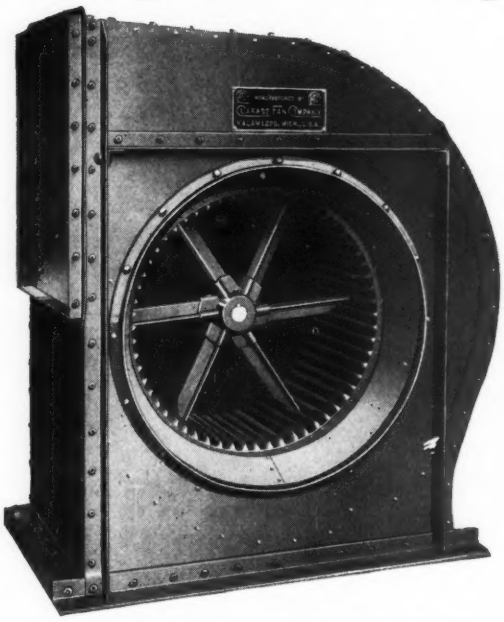

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THE HEATING AND VENTILATING MAGAZINE

Cooperstown, N. Y. FEBRUARY 1918 1123 Broadway, New York

Problems in Locating Radiation Below Boiler Level

One of the most troublesome problems encountered in gravity steam heating is to meet conditions where radiation must be placed below the water-line of the boiler. In forced hot-water systems, this can be done without difficulty; in gravity hot-water systems it may be carried out to a reasonable extent; in vacuum steam systems no trouble is experienced, but in gravity work the situation is entirely different.

As the name implies, a *gravity* system depends upon the force of gravity to return the water of condensation to the boiler—the pressure on each side of the return being the same (or as nearly the same as possible) and the water returning to the boiler due to its own weight.

In a gravity heating job there are some radical features of design which can be altered sometimes so as to avoid the bad condition of having the radiation come below the water-line; for instance, (*a*) the radiation may be slightly increased and located on the ceiling so as to bring it sufficiently high, or (*b*) the boiler may be depressed and set in a pit so as to bring its water-line low enough to allow the radiation in question to be drained, or (*c*) a combination of (*a*) and (*b*) may be used, or (*d*) the system may be changed to a vacuum system, or (*e*) steam may be generated at high pressure and the condensation returned by traps or receiver pumps.

While any of the above may be used to *avoid* such conditions the purpose of this article is to discuss what can be done when, for certain reasons, the system *must* be kept a gravity system, when the boiler *cannot* be depressed and when high-pressure steam is *not* desirable.

A TYPICAL CASE, WITH ONE OR TWO RADIATORS BELOW WATER LINE.

Suppose a small, low-pressure gravity system with the requirements of one or two radiators below the water-line of the boiler and in a building of such character that any mechanical device is not desirable—how can this be arranged?

Since automatic devices are not to be considered, about the only solution is to make the radiator in the shape of a cooling coil, and running the hot water of condensation through it. In order to have the radiator satisfactorily perform its function, the condensa-

tion should flow through the sections to the full capacity of the radiator tappings so as to supply the radiator properly with hot water and in order to keep up a proper circulation. On the other hand, the quantity of condensation returning is a variable factor depending upon the quantity of radiation in use in the building.

For this reason the piping for the radiator should be so arranged as to cause the condensation to flow through the radiator by preference up to the capacity of the radiator tappings and, (when this capacity is exceeded) the surplus condensation should by-pass the radiator, returning directly through the return line without circulating through the radiator. At times, when the radiator may be shut off, *all* the condensation should automatically by-pass the radiator so as not to interfere with the proper operation of the gravity system.

All this can be done with very simple pipe connections arranged as shown in Fig. 1, in which the condensation drops down the pipe leading to the supply connection to the radiator. The boiler water-line (B.W.L.) is high enough to keep the radiator flooded at all times and at the end of the system (where the radiator in question is assumed to be installed) the loss in steam pressure has backed up the return so as to produce a high waterline (H.W.L.). Whenever the condensation in flowing down to the radiator exceeds the capacity of the radiator pipe connections, or the radiator is shut off at the valve, it backs up in the radiator supply pipe until its level reaches the overflow line (O. L.) the excess, or even the entire flow, then spilling over into the return pipe (R), thus leaving the operation of the gravity system uninterrupted. The branches from the steam main for the regular gravity system are not shown in Fig. 1, these being assumed as located in the broken-out portion. Of course, the radiators would be figured the same as a *hot water heating* job, would be of the hot water type with top and bottom connections, and without automatic air valves.

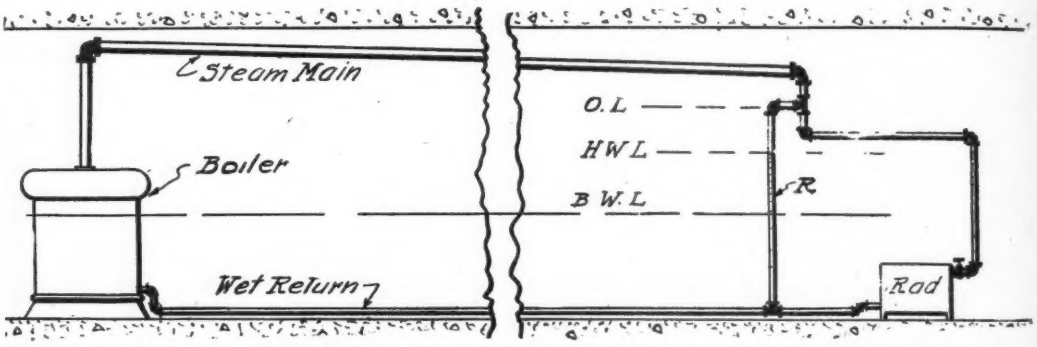


FIG. 1—METHOD OF RETURNING CONDENSATION FROM RADIATOR BELOW WATER LINE WITHOUT USE OF MECHANICAL DEVICE.

A CASE REQUIRING THE USE OF A TRAP.

The next case to be considered is where an operating device is not absolutely prohibited, but the amount of radiation to be taken care of is so small as to make the installation of any power-consuming apparatus out of the question. Under such a condition the use of a trap might be suggested somewhat along the lines shown in Fig. 2.

Here a steam radiator with automatic air valve is used, the radiator being computed for size the same as any *steam* radiator and having its return carried up to a direct-return trap

setting on top of the boiler. The elevation of the trap must be a little above the boiler water-line, as will be seen when the operation of the apparatus is considered; (usually about 4 ft. above the water line is sufficient).

The return trap is provided with a steam connection direct from the steam main near the boiler, so that whenever the trap becomes full of water it operates, closing off the return pipe from the radiator and opening both the steam pipe from the main and the discharge pipe to the boiler return; the vent connection is carried to a closed pet-cock discharging into the air. This results in equalizing the pressure both on the top and below the water in the trap, so that it naturally sinks down the return pipe and into the boiler through the return connection.

As soon as the trap is relieved of its water it automatically shuts off the steam pipe and discharge line to boiler and opens the return line from the radiator. But what raises the radiator return from the radiator level into the trap?

At the time the trap starts to operate, its capacity is entirely filled with steam and water; as it empties and the water descends into the boiler steam rushes in and occupies the space which the water leaves. Thus, when the trap has completed its operation the condition exists of a trap full of steam, and every pipe closed off, except the one from the radiator return. This steam, through radiation losses, almost immediately starts to condense, forming a partial vacuum within the trap and this partial vacuum becomes stronger and stronger as the condensing continues until it literally sucks up the condensation from the lower level of the radiator, the condensation entering the trap and occupying the space left by the condensing steam.

CASES WHERE RECEIVERS ARE USED.

In larger installations, where there are quite a number of radiators to be handled in this manner a receiver is sometimes used at point "X", in which the condensation collects during the time the trap is operating. To start the apparatus all that is necessary is to open the closed pet-cock on the trap vent until steam blows through, showing that the trap is full of steam —which is necessary in order to condense and form the required vacuum. The shutting off of the pet-cock will

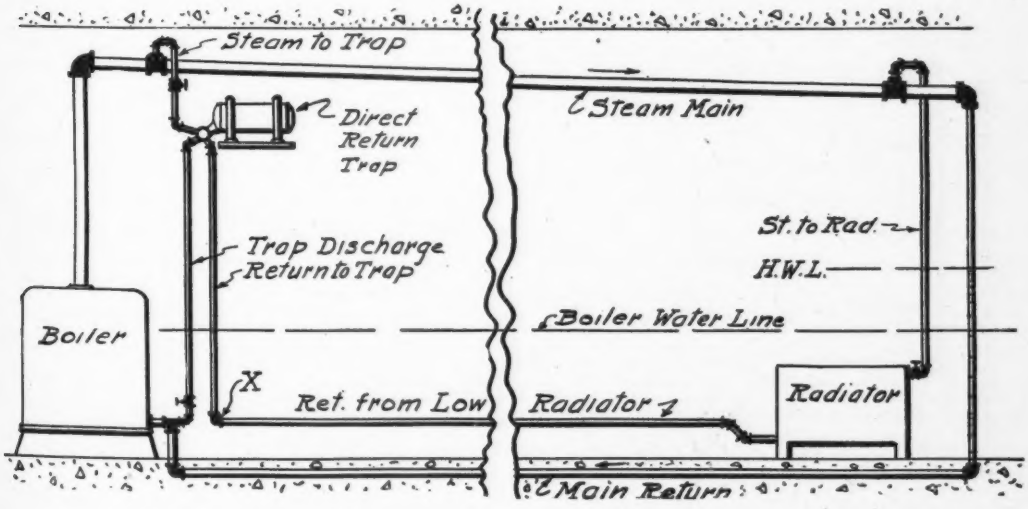


FIG. 2—CASE REQUIRING USE OF A TRAP.

leave the trap full of steam the condensing of which begins the cycle of operation.

Some traps do not automatically shut off the lines and open them again at the proper time, such traps operate the steam supply line only and depend on check valves to do the rest. In such cases a check is placed on the radiator return where it enters the trap and another check on the trap discharge where it leaves the trap. Then, when steam is admitted to the trap, the return check closes and the discharge check opens, permitting the discharge to enter the boiler return line and, when the steam is cut off, the return check opens, permitting the return to enter, but the discharge check is closed so that none of the discharge water is sucked back.

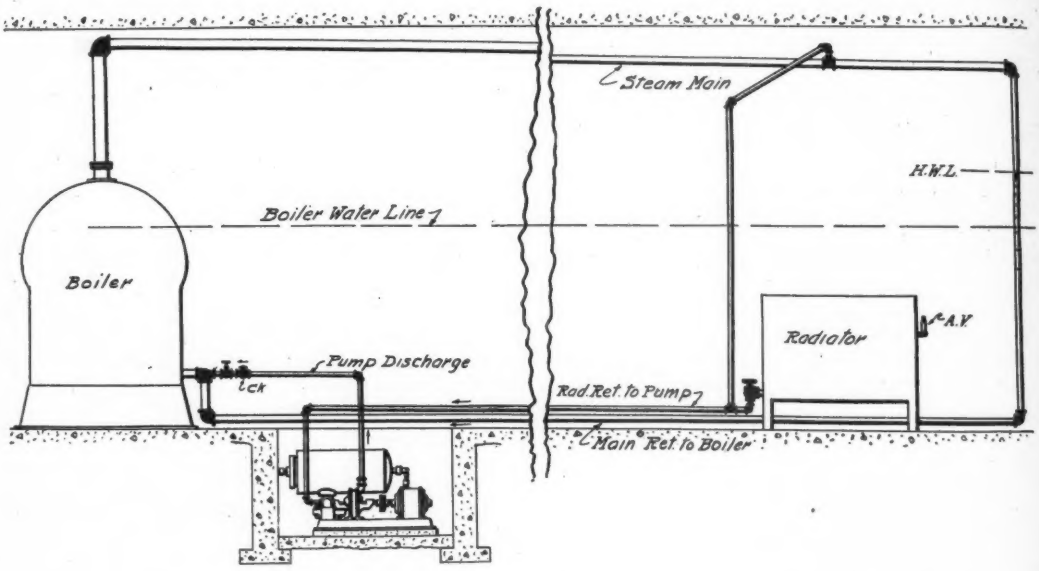


FIG. 3—ARRANGEMENT OF AUTOMATIC RETURN PUMP AND RECEIVER FOR DRAINING LOW RADIATION.

AN AUTOMATIC RETURN PUMP AND RECEIVER SOMETIMES NECESSARY.

When such low radiation increases to a considerable amount the best solution is contained in a small electric-driven automatic return pump and receiver. Where this is used the pump is set low enough to drain all the low radiation into the receiver by gravity. When the receiver is filled with water to a certain level the tilting of the receiver or the action of a float control throws the electric switch and starts the motor which drives the pump.

In Fig. 3 is shown a typical case of this kind with the gravity return going back to the boiler as usual and the low radiator return connected to the pump receiver, set below the radiator level. The pump discharges the return through a check and stop valve into the regular return line, being connected as close to the boiler as possible.

These receiver pumps are also made steam-operated so that where a high-pressure plant is installed, a steam pump can be used at no operating cost at all, the exhaust being turned into the heating system and there utilized. The electric outfits are made in graduated capacities, running from 1000 to 1500 sq. ft. of radiating surface up to 25,000 sq. ft., or larger.

CHICAGO COMMISSION ON VENTILATION

Ventilation Test in an Old Building

The Dante Grammar School, Chicago, Ill.

EDITED BY SAMUEL R. LEWIS

This is the second of a series of reports covering recent work done by the Chicago Commission on Ventilation. These reports will appear exclusively in the columns of THE HEATING AND VENTILATING MAGAZINE, *except that the commission will have reprints available, following publication. The previous report described the test in the Lewis Champlin School, Chicago, and appeared in the December,* 1917, *and January,* 1918 *issues.*

The foregoing test of the heating and ventilating system in the Lewis Champlin School * covered a new plant, in a new building, in a comparatively wealthy neighborhood. For purposes of comparison, the commission carried on tests, at about the same time, of the Dante School, having a similar equipment, but in an old building, built in 1902 and in an addition, built in 1908, in the Ghetto district of Chicago.

In the Lewis Champlin school the pupils come clean and well dressed. In the Dante school compulsory bathing facilities are necessary.

In the Lewis Champlin school the air-ways and ducts were new and presumably free from dust. In the Dante school presumably the dust accumulations of years are present.

The Dante school is located in the east half of the block bounded by Desplaines, Gilpin, Halsted and Forquer Streets. The original building is 229 ft. by 88 ft.; the addition is 145 ft. by 115 ft. There is a basement, three stories and a shallow attic under a flat roof. The building accommodates under an average of 35 pupils to a room, a total of 1,300 pupils. The heating and ventilating plant is located in the basement.

*Published in THE HEATING AND VENTILATING MAGAZINE for December, 1917 and January, 1918.

Attention is called to the general introduction and the detailed description of the heating and ventilating system in the Lewis Champlin school, which so nearly fits conditions at the Dante school that it is unnecessary to repeat it here. Fresh air is taken from the roof level through two shafts, one for the addition, and one for the old building and the assembly hall. Humidity is introduced into the air by means of steam jets, but at the Dante school these are hand-controlled instead of having automatic devices, as at the Lewis Champlin school.

MECHANICAL EQUIPMENT.

The mechanical equipment of the Dante school in general is as follows:

Boiler Plant—300 H.P., horizontal tubular boilers, hand-fired; working pressure around 60 lbs.

Supply Fans—3 units as follows:

1. Old building, one standard steel-plate, centrifugal housed blower; wheel 9 ft. in diameter, direct-connected to a 9½ x 12 in. steam engine.

2. New Building, one standard steel-plate, centrifugal housed blower; wheel 8 ft. in diameter, direct-connected to a 9½ x 12 in. steam engine.

3. Assembly Hall, one standard steel-plate centrifugal housed blower; wheel

FRONT VIEW OF DANTE SCHOOL.

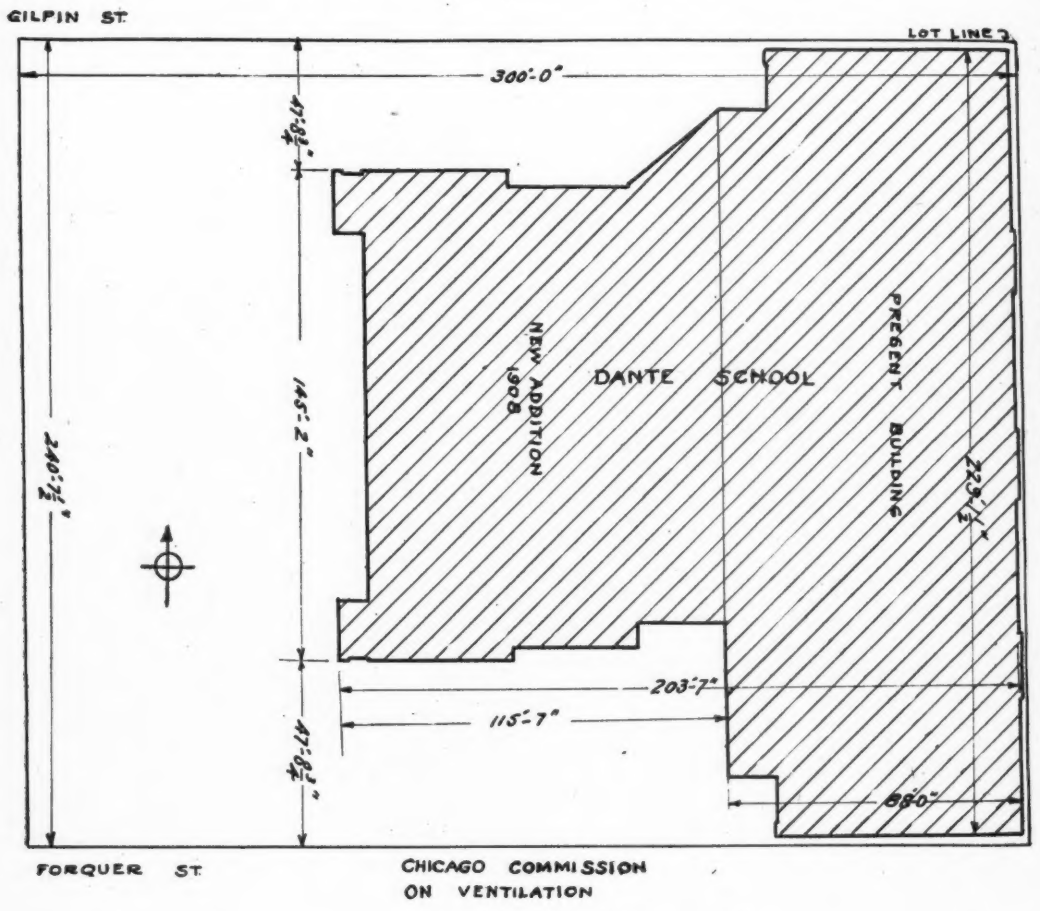
REAR VIEW OF DANTE SCHOOL.

5 ft. 6 in. in diameter, direct-connected to a 7 x 10 in. steam engine.

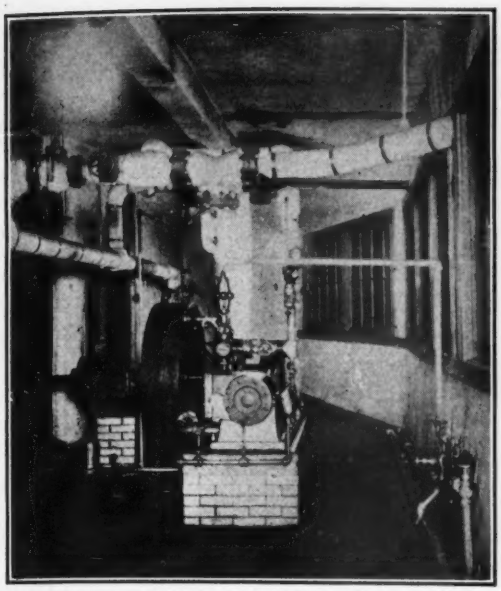
Heaters:

1. Old Building—the tempering and re-heating coils being of 1-in. pipe in cast-iron bases, are placed at each of the two discharge openings from the fan. In the two groups which supply two plenum chambers, there are 5200 sq. ft. of surface.

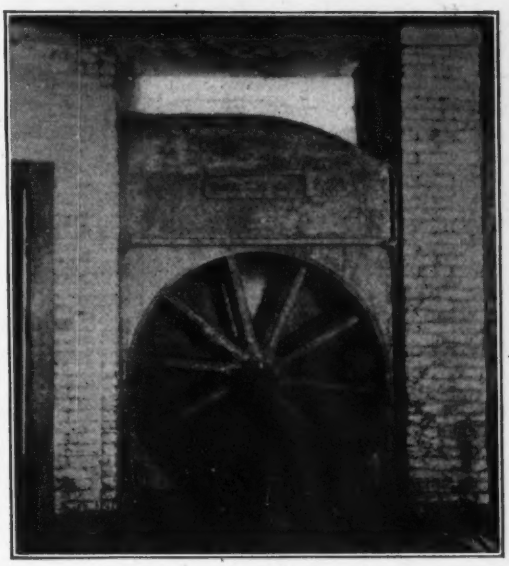
2. New Building—the arrangement is similar to that in the old building. Total radiation, 3372 sq. ft.



PLAT PLAN OF DANTE SCHOOL.



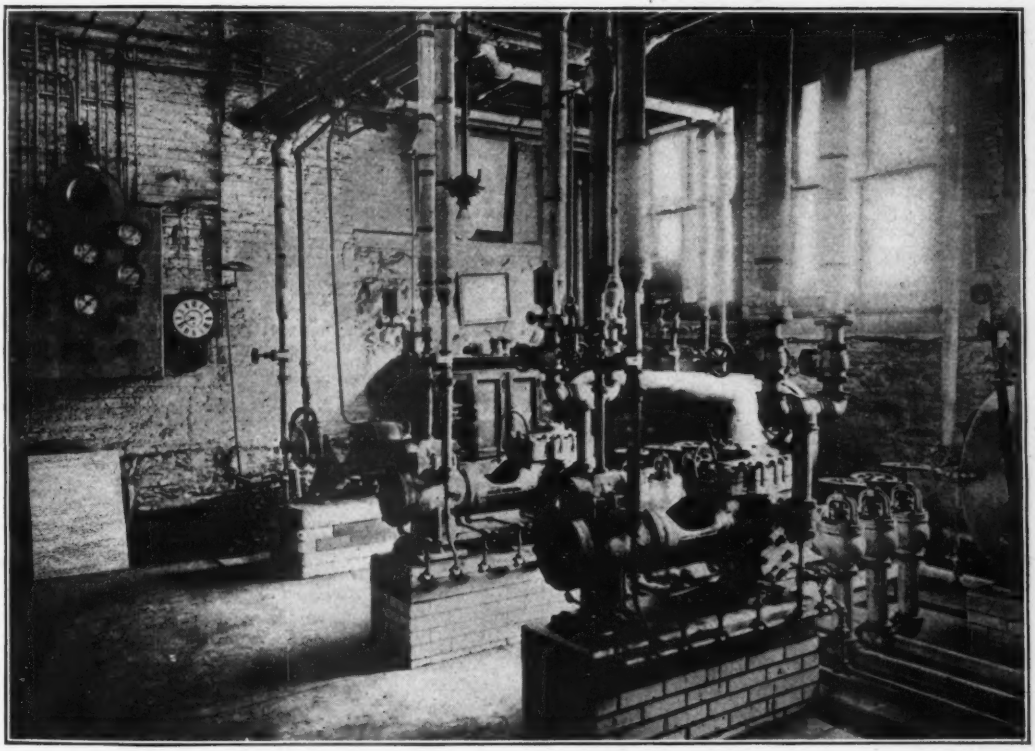
ENGINE DIRECT-CONNECTED TO FAN.



FAN, FROM INTAKE SIDE.

3. Assembly Hall—there is a single group of heaters at the fan outlet; total radiation, 980 sq. ft.

Since the testing of the Dante School was done by the same persons who tested the Lewis Champlin School, the technique had been established, and we are able fairly to present an average as well as individual tests. The various conditions ob-



TANK AND ENGINE ROOM, DANTE SCHOOL.

served will be discussed under the same general classification as for the Lewis Champlin school. Test sheets are shown covering observations in the kindergarten, and in rooms 105, 109, 202, 205, 209, 304, 306 and 311.

KINDERGARTEN DANTE SCHOOL.

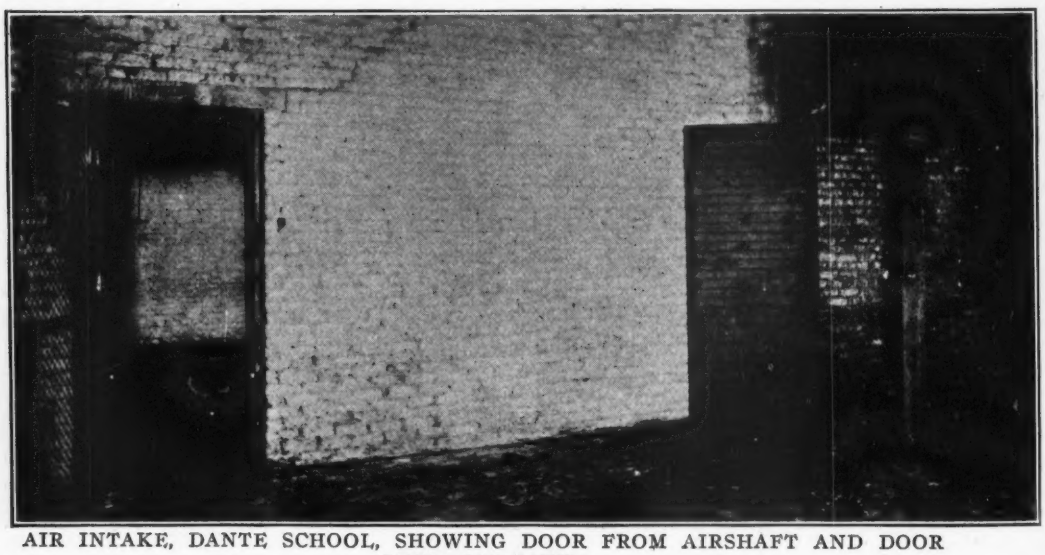
Dante Kindergarten
Feb. 15, 1917.

This may fairly be compared to the test of room 209 of the Lewis Champlin school, of March 9, as both rooms were at the southeast corner, with a southwest wind.

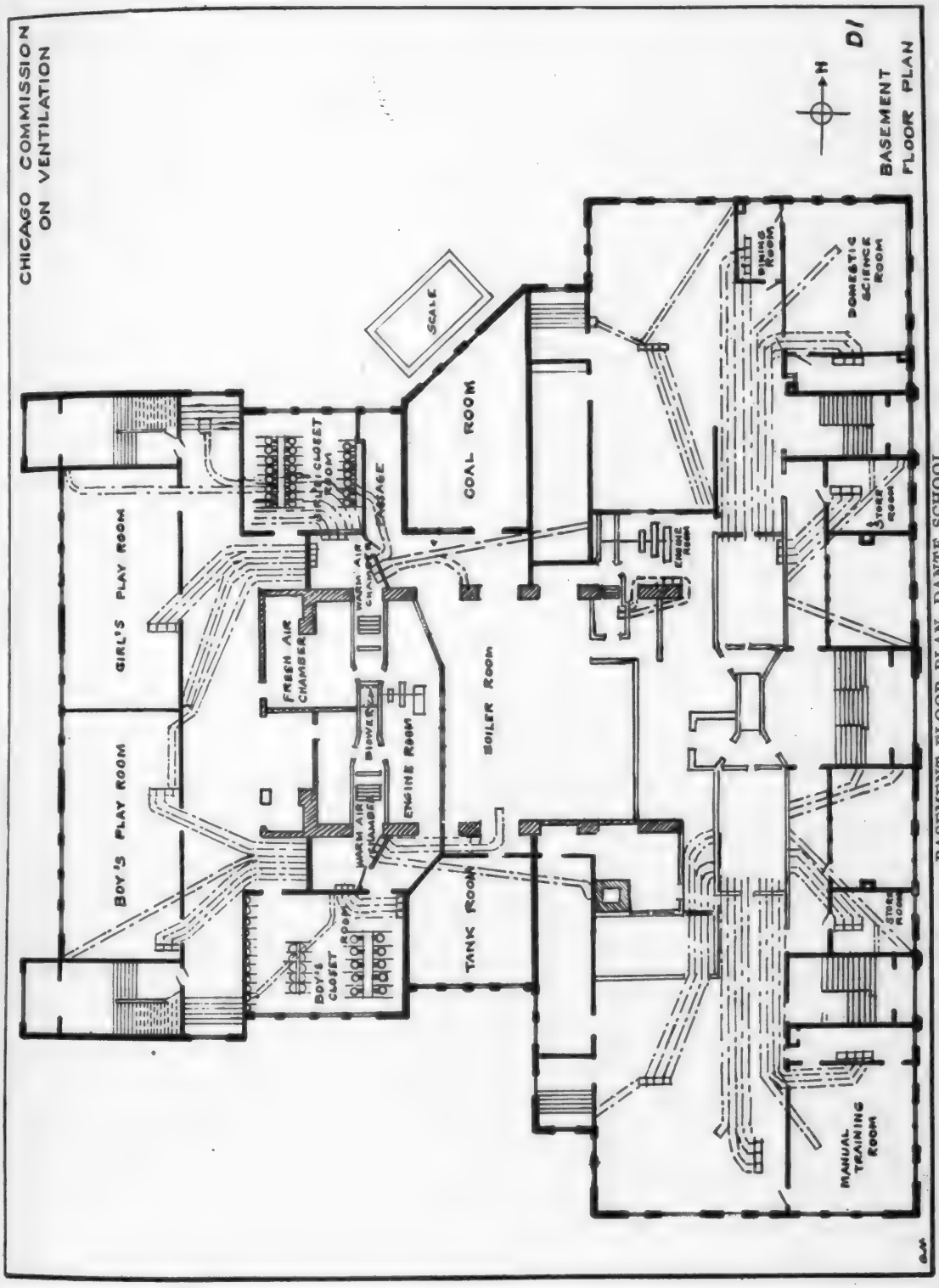
	Cubic Feet Air space per Pupil	C.F.M. per Pupil	Ave. Temp. Deg.F. Dry	Wet	Av. Rel. Humidity Per Cent.	Av. Dust	Av. Bacteria	Av. CO_2	Excess of CO_2 over outside
Dante Kindergarten	370	48	74	55	27	20600	18	9.3	5.4
Lewis Champlin 209	290	30	70	52	27	51000	5.2	6.4	2.2

In both rooms the leakage was outward; in the Dante about 23% of the air introduced leaked out elsewhere than at the exhaust. At the Lewis Champlin this percentage was about 25%. It will be noted that the pupils at the Dante were receiving in excess of 50% more air per minute than at the Lewis Champlin. In both rooms the location of supply and exhaust openings was similar. The Dante supply opening, however, is 96x7¾ in. while at the Lewis Champlin it is 72x19 in., giving a much lower inlet velocity. The CO_2 outside at the Lewis Champlin, was 4.2 parts, compared to 3.4 parts at the Dante.

In the Dante school the exhaust is at the floor, drawing off the contaminated air near an interior wall, while at the Lewis Champlin it is at the floor, drawing off the contaminated air nearer to an exterior wall. In the Dante the supply is at the center of an interior wall, discharging toward the glass at the south, at a velocity high enough to create an injector

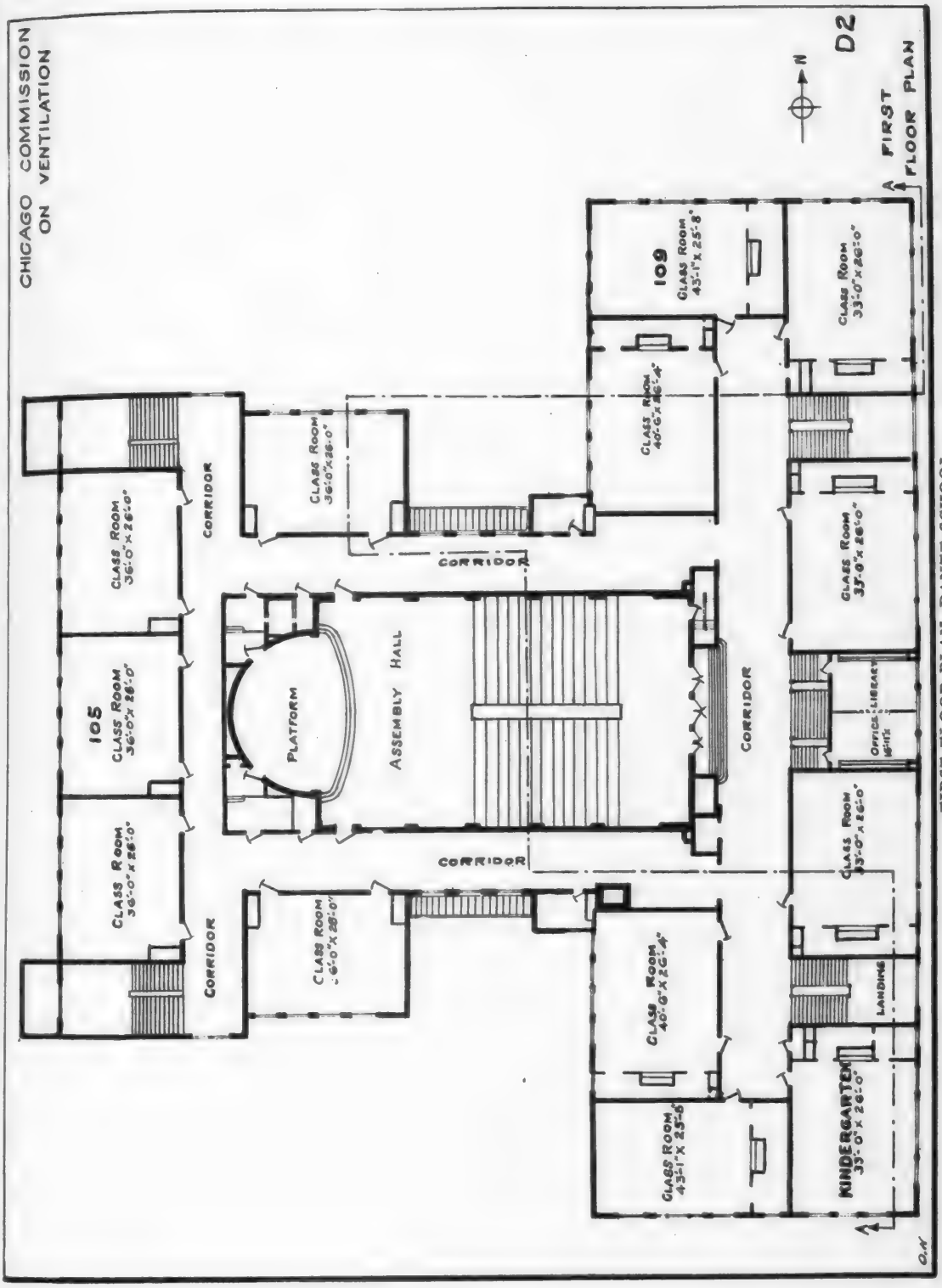


AIR INTAKE, DANTE SCHOOL, SHOWING DOOR FROM AIRSHAFT AND DOOR FROM BASEMENT.

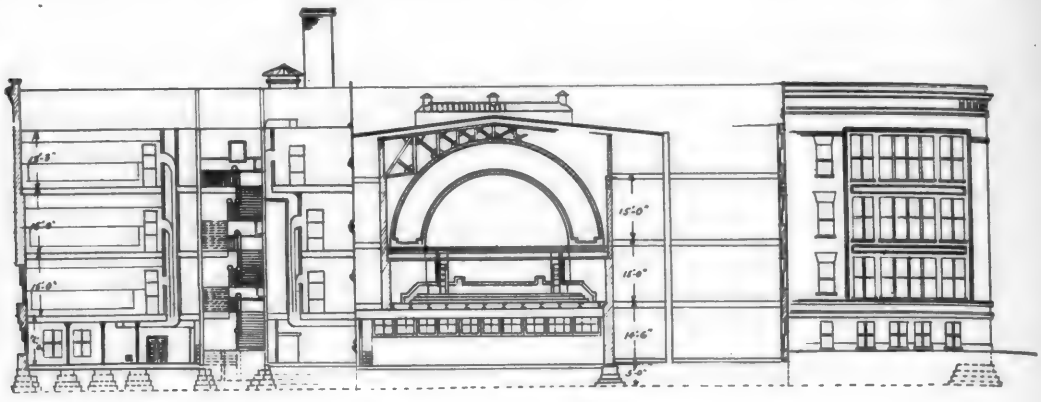


BASEMENT FLOOR PLAN, DANTE SCHOOL.

CHICAGO COMMISSION ON VENTILATION
PLAN OF ROOF & ATTIC D5
LONGITUDINAL SECTION
ELEVATION
CROSS SECTION
DETAILS OF FRESH AIR SHAFT "A"
ROOF OF ASSEMBLY HALL
DIAPHRAGM
DETAILS OF FRESH AIR SHAFT "B"
SECTION
ELEVATION
END
PLAN OF ROOF AND ATTIC, DANTE SCHOOL.



FIRST FLOOR PLAN, DANTE SCHOOL.



SECTION "AA"

CROSS-SECTION OF DANTE SCHOOL.
(See First-Floor Plan.)

effect, causing a recirculation of contaminated air along with the jet of fresh air. In the Lewis Champlin, the supply is close to an interior wall, discharging toward a cold exterior wall, at low velocity. The injector effect was not noted here.

In the Dante part of the fresh air seems to have been thoroughly mixed with the contaminated air, and to have kept a large part of the same in constant circulation, as evidenced by the high CO_2 observation. In the Lewis Champlin, however, the fresh air

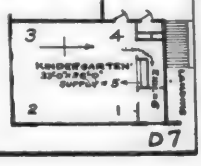
TEST DATA - DANTE GRAMMAR SCHOOL — FEB. 15, 19, 27 - 1917.

KINDERGARTEN:- VOLUME = 11,800 Cu. Ft. - SUPPLY REG. = 96" x 7½" = 5.2 ft. EXHAUST REG. = 19½" x 25½" = 3.5 ft. EAST & SOUTH EXPOSURE

Time	Occupants	Air Space Per Occupant	Supply Vel Ft. Per Min.	Supply Vol C.F.M.	Exhaust Vel Ft. Per Min.	Exhaust Vol C.F.M.	Location	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. Per Min.	Dust Particles Per Cu. Ft.	Bacteria Per Cu. Cm. Plate	Odors % Standard	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
Feb. 15 10:15	38 Pupils & Teachers		300	1560	340	1190	1	74	55	27		Intake 17900	23		9.4	28	80	S.W.	12
							2	74	55	27		Dancing 23300	16		10.5				
		Fan = 170 R.P.M.					3	74	55	27			24		8.0	CO_2 outside = 3.4			
							4	74	55	27			10		9.4				
	32	370	300	1560	340	1190	Ave.°	74	55	27	40	20600	18	90	9.3	Distribution = 92.7%			
Feb. 13 2:30	32 Pupils & Teacher		385	1900	475	1660	1	79	58	26			5		7.2	35	80	S.W.	14
							2	79	58	26			13		9.0				
		Fan = 174 R.P.M.					3	79	58	26			55		9.0	CO_2 Outside = 3.8			
							4	79	58	26			26		10.2				
	31	380	365	1900	475	1660	Ave.	79	58	26	40	19000	25	90	8.8	Distribution = 90.3%			
Feb 27 12:15	36 Pupils & Teacher		260	1350	320	1120	1	68	52	30		28000	7		6.0 6.4 6.7 6.7	21	48	N.W.	10
							2	68	52	30		"	9						
		Fan = 170 R.P.M.					3	68½	52	29		"	26		4.8 6.7	CO_2 Outside = 3.4			
							4	68½	52	28		"	64		7.1 8.0				
							5					9500							
							6					22,500							
							Intake					6000			3.8 4.0				
	38	310	260	1350	320	1120	Ave	68½	52	29½	40	28000	27	95	6.6	Distribution = 31.5%			
Feb. 19, 27	34	353	310	1600	380	1320	Total Ave.	74	55	27	40	22,500	23	92	8.2	" = 91.4%			

On Feb. 19 - Air left supply and traveled to ceiling dropping to breathing zone at south wall and returning near floor also currents traveled down east wall and quickly left window for center of room.

On Feb. 27 - Air traveled along west wall near ceiling and dropped to floor - returning around southeast and north wall and in passing under supply register to exhaust door. Some of the air was drawn back to the supply registed and recirculated.



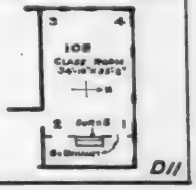
TEST DATA FOR KINDERGARTEN.

TEST DATA - DANTE GRAMMAR SCHOOL — FEB. 15, MARCH 1, 1917

ROOM 109 — 1ST GRADE — VOLUME - 11800 CU. FT. — SUPPLY REG. = 36" × 7 3/4" = 5.2 ft. — EXHAUST REG. = 22" × 28" = 3.5 ft. — NORTH CORNER

Time	Occupants	Air Space per Occupant	Supply Vel. F.P.M.	Supply Vol. C.F.M.	Exhaust Vel. F.P.M.	Exhaust Vol. C.F.M.	Station	Temperature dry Bulb	Temperature wet Bulb	Rel. Hum. %	Air Motion F.P.M.	Dust Particles per C.F.	Bacteria 24 hrs. Count	Odors & Fumes	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
Feb. 15 12:45	51 Pupils 1 Teacher		420	2180	450	1580	1	68	50	25		Spoiled	9		6.4	28	80	S.W.	12
							2	68	50	25			7		6.7				
		Fan = 174 R.P.M.					3	69	50	23			6		5.2	CO_2 outside = 3.4			
							4	69	50	23			8		5.5				
	52	368	420	2180	450	1580	AVE.	68½	50	24	60		8	85	6.0	Distribution = Good			
Feb. 1 8:40	38 Pupils 1 Teacher		380	1980	455	1600	1	67	48	22		51000	52		6.2 6.8	20	53	N	N
							2	67	48	20		"	42		6.8 7.1				
		Fan = 164 R.P.M.					3	68	43	21		"	58		6.3 7.4	CO_2 Outside = 4.0			
		"					4	68	43	21		"	67		6.7 8.5				
							5					35000							
							6					56500							
							INTAKE					22000							
	35	337	380	1980	455	1600	AVE.	67½	48½	20½	60	57000	55	85	6.8	Distribution = 94.5%			
	34	347	400	2080	453	1590	TOTAL AVE.	68	43½	22½	60	51000	31	85	6.4	"		= 92.5%	

Air traveled toward window and immediately dropped passing around the rear of room then the south side and this circular motion seemed to carry more air to the exhaust thru the north door than the south and some of the air in passing under the supply register was drawn up by it and recirculated.



TEST DATA FOR ROOM 109.

passed around the warmer sides, dropping to the floor as cooled by the exposure, and passing off in a general effect such as to produce ventilation by displacement, as evidenced by the consistent CO_2 observation. In both the temperature and humidity were improperly balanced; both should have been kept cooler as to dry bulb, and higher as to moisture.

Nothing in any of the observations at the Dante as to dust indicated any particular increase in dust attributable to the older ventilating plant. The higher bacteria count at the Dante is perhaps due to the condition of clothing and bodies of the pupils, or may be due to the fact that the Lewis Champlin school had been fumigated the previous afternoon. Comparing however, with other Lewis Champlin rooms, 209 was unusually low in bacteria, and the other rooms tested were more consistent with the Dante, despite their recent fumigation.

It will be noted that the three tests of the Dante kindergarten show undue variation in the volume of air delivered at the same fan speed; undue variation in temperature, and consistently too low relative humidity. The air distribution improved, as per CO_2 indication, on Feb. 27, when the wind was from the northwest. The dust increased materially that day with a lower outside relative humidity. These latter observations, it will be noted, were made when the air supply per minute per pupil was reduced to about 35 cu. ft., instead of 48 cu. ft., as on Feb. 15.

Dante 109 is similar in plan to the kindergarten and the same remarks apply to it. Some local condition for which we cannot account must have been responsible for the remarkably high dust and bacteria observations of March 1.

In next month's issue the results will be given of tests in Rooms 209, 105, 304, 202, 205, 306 *and* 311, *together with the conclusions of the commission.*

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Important Actions Taken at Society's Annual Meeting, in New York, January 22-24, 1918

Actions of unusual importance were taken at the twenty-fourth annual meeting of The American Society of Heating and Ventilating Engineers, which was held at the Engineering Societies Building, New York, January 22-24. After many years of effort the final draft of a code for testing low-pressure heating boilers was accepted by the society and will be promulgated as the society's standard code for this purpose in the future.

Another action which, in its possibilities, outranks anything the socity has ever done, was the decision to establish a research laboratory where tests can be made of all kinds of heating apparatus and devices, as well as of methods, the results, when finally accepted by the society, to be put forward as standard practice. The details of the plan are given on another page in the report of the research bureau committee.

FREDERICK R. STILL
President, American Society of Heating and Ventilating Engineers.

The matter of a warm-air furnace code was taken up and the society voted to go ahead with the preparation of such a code, both for testing and for methods of installation.

War had its effect on the attendance, but the well-arranged program held the close attention of the goodly number present. The total registration was 108 members and 59 guests.

Tuesday Afternoon Session, January 22

The opening session convened Tuesday afternoon with President J. I. Lyle in the chair. After appointing the tellers, consisting of H. M. Hart, F. T. Chapman and A. E. Stacey, President Lyle addressed the meeting. His remarks were principally a review of the society's progress during the past year, with special reference to the work being done for the government. The committee on battleship and submarine ventilation has already submitted many suggestions for simplifying this equipment and as a result some of the submarine designs will be revolutionized. He then referred to the committee that had been appointed to serve with the National Defense Council. These appointments, he said had not yet been confirmed by the Defense Council.

Efforts to arrange for closer co-operation with the National District Heating Association, he said, had resulted

in the appointment of committees from each organization to bring this about. A joint meeting was planned, with separate business sessions, but at present time it is not certain that the National District Heating Association will hold a convention next summer. If it does the joint meeting will be arranged for some time in June.

President Lyle spoke of the record made in the number of new members added to the rolls during the past year. The total came to 139 which means a net increase of 74 for the year. The financial position of the society, he said, was better than ever before.

The report of the council contained, among other things, a proposed amendment that members over 70 years of age who had been 15 years in business, should be made life members without the payment of any additional dues. This proposal was later adopted. The council reported that there were 38 stars on the society's service flag. The members were also informed that the society was now in possession of the library of the late Alfred E. Kenrick and that these volumes and papers were now a part of the society's library.

Secretary C. W. Obert reported total receipts for the year of $11,809.47 and disbursements of $11,098.28, leaving a balance of $711.19. This, with the balance on hand at the beginning of the year of $4,004.92, brings the present balance to $4,716.11. The society's total assets at the present time are over $15,000 while its total liabilities are $1,155.00, leaving a membership equity per member of $14.63. The amount of outstanding dues is $2,048.00.

Secretary Obert reported that there were 821 members now on the rolls.

Under committee reports that of the committee on schoolhouse standardization was put over to a later session, but it was voted to continue the committee.

Report of Committee on Research Bureau

Perry West reported for the Committee on Research Bureau, George W. Barr, the chairman, having been called into active military service. This committee reported at the last summer meeting of the society. No definite disposition was made of the matter at that time and the committee was asked to continue and report later. The report continues:

1. There is no question in the minds of your committee that the heating and ventilating industry is greatly in need of specific determination bearing upon the co-ordination and standardization of the practices of this art and that the Society of Heating and Ventilating Engineers is the proper organization, not only to perform some of this work, but to assume the direction and encouragement of such of this work as should properly be done by others.

2. The society itself is in need of some fundamental common cause upon which the energies and interests of its members can be centered, and which would increase the vigor and health of the society and place it in the position which it should occupy among the affairs of men.

3. There is no greater work before the heating and ventilating engineers than: 1st—a determination of the standards and practices which will turn to best economic account the various apparatus which are available for use in connection with this work; 2d—the co-operation with, and direction of, manufacturers in the determination of reliable data as to the performance of their apparatus and the further development of this apparatus to best meet requirements, and 3d—the education of the consumer and others with whom we come into business contact along the lines of better co-operation and as to what we are attempting to do.

4. The society should take immediate steps to put the proper forces into operation to accomplish the above results.

Our specific recommendations as to the ways and means of going about this undertaking are as follows:

1. The president of the society should be

authorized to appoint a committee, consisting of the treasurer of the society and two other members (approved by the council), to raise a fund by a popular subscription of not less than $25.00, or more than $100.00 from any one person outside of members and of any amount from members; the same to be paid annually for a period of five years; this fund to aggregate not less than $3,600.00 per year, nor more than $5,000.00 per year; the same to be known as the "Research Laboratory Fund" and to be used as hereinafter specified.

This fund to be collected upon the following basis: That the heating and ventilating engineering profession as well as those associated with or interested in it, can well afford to pay for definite determinations of a standard working basis for all. That the work to be undertaken shall include broad principles, and any such as are applicable to the use of all classes and makes of apparatus without fear or favor for any. That the immediate work of the laboratory shall consist of determinations of the conditions to be met and the best methods of meeting same with available apparatus and only concern itself in the apparatus itself insofar as to cooperate with manufacturers in having them test and develop their own apparatus along lines to best meet these requirements. Contributions to involve no obligation beyond that of the donor to his profession or best interests in the arts of heating and ventilation.

Among examples of some things the laboratory might undertake, are the following: Co-ordination of existing data; standards of heating and ventilating; how fast and to what degree buildings cool down over night and holidays; the rate and load during heating up periods; what is a reasonable amount of attention required by apparatus, etc.

Among examples of some of the things the laboratory might ask manufacturers to furnish are: The rate of evaporation and economy of a boiler at minimum efficiency and at maximum load and the draft and period of firing in each case; the exact surface and transmission factors for radiators and the effect of locations on this, fan performances, engine performances, etc.

2. The council of the society should be authorized to make all arrangements for and to appoint a director for this research work, at a salary of not more than $3,600.00 per year; this director to have charge of and take over all of the work of this undertaking under the direction of the council, provided, however, that no such appointment or arrangements shall be entered into until the above-mentioned fund for same is secured, and an arrangement can be perfected which would be for the best interests of the society. This work to be carried on in conjunction with some university or universities of national repute or the proper governmental departments, or both, as may be decided, for the best interests of the society. Any funds collected in excess of the director's salary and not in excess of $5,000.00 per year, to be used by the president and the council for defraying other expenses incident to this undertaking, or to be allowed to accumulate as a contingency fund for this work as conditions may warrant. Any and all funds subscribed or collected in excess of $5,000.00 per year to be cancelled or returned on a provided basis. All such matters to be within the entire discretion and jurisdiction of the council.

3. The work of this department to be confined to the co-ordination and tabulation of existing data and to such research work as would naturally fall within the province of heating and ventilating engineers to determine, and to the organization and promulgation of a plan whereby manufacturers may be directed and co-operated with in conducting such research and testing work as will produce the required definite data as to the performance of their various apparatus and the proper development of same in connection with the art of heating and ventilating work.

4. This work shall only be undertaken on the condition that some reputable university or governmental department can be arranged with to furnish the necessary accommodations, apparatus and co-operation to satisfy the council that this undertaking may have the necessary co-operation to make it a success.

5. The director of this work should be required to report monthly to the council as to the work and findings of this bureau. Such reports or data therefrom to be edited and published by the council through the publication committee from time to time in the Journal of the society as official conclusions of The American Society of Heating and Ventilating Engineers upon the various subjects handled by the bureau.

After considerable discussion, all of which, however was favorable to the plan proposed, the report of the committee was referred to the council, with the tacit understanding that the

plan is to be gotten under way at an early date.

The treasurer's report was presented by Homer Addams, giving in detail the totals presented by the secretary.

James A. Donnelly brought up the need of certain amendments to the charter of the society which were necessary for taxation purposes. These were referred to a later session and then presented in written form and adopted.

CHAPTER REPORTS

Chapter reports presented by the Illinois, Eastern Pennsylvania, Michigan and New York chapters showed all of them to be in a highly satisfactory condition. The Massachusetts Chapter was reported inactive. The petition of the Minneapolis members to form a new chapter to be known as the Minnesota Chapter, was unanimously granted. It is proposed to take in members from the Twin Cities as well as from Duluth and other points.

The work of the Chicago Commission on Ventilation was reviewed for the benefit of the members by J. H. Davis. Mr. Davis said that the commission has completed tests in two factory buildings and in two school buildings. These are being given in full in the columns of THE HEATING AND VENTILATING MAGAZINE. Further tests are being arranged for in the Chicago-Northwestern Building and in the Chicago-Quincy Building. The Normal College testing-room is also to be used in making an elaborate comparative study of open-air and ordinary school ventilation by mechanical means.

The Michigan Chapter reported nearly 100 members. Among the live subjects they are working on are the matters of standardizing vacuum heating specialities as to sizes and capacities and the protection of radiators on sleeping porches from freezing. F. K. Chew, president of the New York Chapter, recommended that the chapters exchange abstracts of their meetings so that they may widen the effect of their papers and discussions.

Tuesday Evening Session, January 22.

THE NEW OFFICERS.

The tellers announced the election of the following officers for 1918:

President, Frederick R. Still, Detroit, Mich.

First Vice-President, Walter S. Timmis, New York.

Second Vice-President, E. Vernon Hill, Chicago, Ill.

Treasurer, Homer Addams, New York.

Members of the Council: William H. Driscoll, New York; Howard H. Fielding, Denver, Colo.; H. P. Gant, Philadelphia; Charles W. Kimball, Boston; J. Irvine Lyle, New York; Frank G. Phegley, Cleveland; Fred W. Powers, Chicago; and Champlain L. Riley, New York.

The Tuesday evening session was devoted to the subject of drying. H. C. Gore, chemist with the Department of Agriculture, opened the session with an account of the recent progress made in the drying of fruits and vegetables, with special reference to the developments since the last summer meeting of the society which he also addressed. Mr. Gore said the small dryer, using only an electric fan without heat, was extensively used in the Middle West last summer and that it was surprising how successfully it had done the work. He exhibited numerous photographs of the various devices used by the department in preparing fruits and vegetables for the drying process and showing the processes in operation. He stated that this work was being done on an ex-

tensive scale in Canada and passed around photographs showing an installation where 1,000,000,000 lbs. of food are being dried annually. He stated that the United States Government is keeping in close touch with the department in the drying proposition and that important devolopments were to be expected if it is found necessary to send foodstuffs to the troops abroad for any length of time.

Mr. Gore was asked many questions in a running fire of discussion and was given a vote of thanks at the conclusion of his remarks.

A paper on "High Temperature Drying" was then presented by B. S. Harrison

High-Temperature Drying.

Mr. Harrison's paper was first presented at the December meeting of the New York Chapter, as reported in last month's issue. For the past few years Mr. Harrison has devoted his attention almost exclusively to drying work and his paper was practically a review of the information he had gleaned in that field. The paper covered a wide range including the drying of such products as linseed oil, hay, alfalfa, copra, asphalt japan coatings, and insulation blocks. He spoke particularly of the drying of insulation blocks of asbestos, magnesia and diatomaceous earth in sheets 4 in. thick as taking weeks at low temperatures and with radiant heat and which require days at higher temperatures with direct flame, gas heat. With hot air at high velocity at 600 to 800° F. they dry in 8 hours.

Mr. Harrison gave some interesting points in connection with the design of high-temperature installations. He said so little is known regarding the specific heat, latent heat of evaporation and fusion of many liquids, oils, gums, etc., used in commercial processes, that laboratory experiments are necessary to establish the controlling conditions for commercial installations. Hot dry air sometimes carries static electricity in a drier. This can often be overcome by putting a small steam spray into the air supply, although this has to be taken care of in the amount of heat supplied, as the steam must be superheated.

Aerated water has a highly oxidizing effect on metals, but humidified air, even at high temperature, has, as compared with dry air, a retarding, oxidizing effect on linseed oil, varnish and other sicative coatings. The use of ozone or ozonated air in this connection is of little use.

While textbooks state that ozone (0_3) returns to the oxygen state (0_2) at 300° F., Mr. Harrison's experience has been that at even 150° F. it no longer has the oxidizing effect of nascent oxygen. Mr. Harrison has also tried desiccating water out of materials by means of electricity, but the cost of the work was found to be out of all proportion and the action slow.

When heating gases carrying sulphur it is necessary to protect the through rods of the heater. The best mixture for this purpose was found to be Portland cement mixed with buttermilk. This will stand temperatures up to 1,200° and is flexible. Regarding the choice of fuels for drying work, as done with the Aertube heater, he said any gas or oil is easily subject to thermostatic control. Contrary to general belief, the easiest oil fuel to handle and control and the easiest on the heater and brickwork, as well as the cheapest, is the heaviest Tampico crude oil of 11 Beaume. When properly installed and heated to 160° before atomizing and when operated under thermostatic control, it gives a minimum of trouble.

This was followed by a paper on "The Temperature of Evaporation," by W. H. Carrier.

ANNUAL DINNER OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, HOTEL ASTOR, NEW YORK, JANUARY 24, 1918.

Wednesday Afternoon Session, January 23.

Those who attended the fuel conservation session were rewarded by an afternoon of the liveliest interest. Professor L. P. Breckenridge, of Yale University was the opening speaker and gave the members a remarkably clear view of the present coal situation and its causes and prospects, as well as many useful hints on ways and means of effecting economies in coal consumption. The address of Professor Breckenridge, who was representing the United States Fuel Administrator, was illustrated by lantern slides bristling with statistics of the coal industry, including segregations of such items as the amount of coal used by each industry, as well as the production and distribution of the coal itself. The speaker showed, for instance, that of the total amount of freight carried by the railroads, coal constitutes 35 per cent and for the eastern sections alone, it amounts to 45 per cent.

We must learn to burn bituminous coal, said the speaker, and his curves showed very pointedly the increases in the amount of bituminous coal mined, as compared with anthracite, during the past few years. Two-thirds of all the coal we use, said the speaker, goes for making steam, while 16% is used for domestic purposes.

The speaker went over in detail the various industries using coal and pointed out those that could and those that could not effect savings during the balance of the winter. He showed that the best results that could be gained by this method of estimation were about 10,000,000 tons, while the amount needed to be saved was 50,000,000 tons. How the remaining 40,000,000 tons are to be saved, is a problem, said Professor Breckenridge, which he could not solve. He said it was simply impossible to mine and deliver the extra amount needed. It would have to be saved even if it meant the closing down permanently of some of the industries.

Professor Breckenridge then took up the best way of firing heaters and had some novel suggestions to offer for running the house heater. The principal thing, he said, is to control the air going through the fire. That is the only reason for shaking down the fire, outside of keeping the fire-bed from getting too high. Therefore, the lower ash doors are not needed. They might just as well be taken off and thrown away. Plenty of control is provided by the dampers. He urged the closing or partial closing of the smoke damper all of the time.

Regarding the burning of wood in house heaters, he said that this can be done although the heaters are not properly designed for this purpose. It is advisable to get a layer of ashes on the grate as soon as possible so that the fire may be checked when desired. Wood, he added, has a heating value about one-half as much as coal.

Before finishing the discussion of his address, a paper on the same subject of fuel conservation was presented by George W. Martin, president of the National District Heating Association. Mr. Martin said that without going into the merits of the controversy on the subject of isolated vs. central power plants, it was proving a fact that at the present time a change to central plant service is proving a means of economy. Another point emphasized by Mr. Martin was the need of steam-meters for universal use. There are plenty of efficient types manufactured, he said, and they effect economies wherever installed. The Illinois Maintenance Company is putting in steam meters as rapidly as possible and the New York Steam Company is saving 25% with steam meters over the previous cost.

A measure of economy that can be widely applied is the elimination of ice from drinking water. Laundry dry-

ing can be replaced by roof drying. We can reduce indoor temperatures to 68° F. We can watch the fire more closely and obviate the need of opening the windows to cool the house. He also recommended the recirculation of air at night in warm-air furnace heated houses.

Discussing the recommendations, Professor Breckenridge said that if we would consider coal as free and air as the expensive item we would soon come to learn the vital importance of controlling the air going through the fire.

It was suggested that we develop water rates for steam heated buildings by which it could be determined how much coal certain types of buildings could get along with.

Charles R. Bishop, of the American District Steam Company, gave some figures regarding the closing down of his company's plant during the recent five-day shut-down period. He stated that it was necessary to maintain the temperature to 40° F. and, without operating the machinery the cost was only a trifle less than at full operation and maintaining 70° F.

An interesting point mentioned by Professor Breckenridge was that in the ordinary power plant 85% of the cost is in the coal. In the case of the manufacturer of some other product, such as locks, keys, etc., the cost for fuel averages only about 1%. In railroad work, fuel amounts to 5% or 8% of the total operating cost.

The discussion then turned on the matter of maintaining the desired amount of moisture in houses and W. J. Bahnson of the Normal-air Company, described an arrangement he had installed in his own residence whereby he is able to maintain between 45% and 50% relative humidity in zero weather. He uses from 1.3 to 1.6 gal. of water per hour, the house being 50x36 ft. The arrangement he uses includes a water spray and an electric fan, together with a duct leading from the top of the furnace to the spray and then back to the furnace again, re-entering the casing near the bottom. Besides adding humidity this arrangement also accelerates the circulation of the air through the furnace.

LIMITING THE FUEL SUPPLY TO INDIVIDUALS

President Lyle brought up a point that had been suggested by the Bureau of Mines of limiting the supply to individual residences. Following out this idea, Frank T. Chapman stated that a reasonable proposal in this connection would be:

One-fourth-ton per room per month, for the months of December, January and February.

One-fifth-ton per room per month, for the months of October, November and March. Baths and service rooms to be counted as half-rooms and the hall to be considered as one room. An allowance, also, would have to be made for warm and cold localities. It was voted to bring this subject to the attention to the United State Fuel Administration through the society's fuel committee so that there would be something to go on in case the necessity for such drastic action should arise. In applying the formula to their own homes several of those present found from their computations that the rule gave an average of 90% of their present coal consumption for the heating season.

A paper on the specific subject of "Economy in Fuel," was presented by Perry West.

Economy in Fuel.

Mr. West's paper, first presented to the New York Chapter, at its November meeting, was published in abstract in THE HEATING AND VENTILATING MAGAZINE for December, 1917. So many practical suggestions, however,

are contained in the paper that it is presented herewith in full:

There are two general ways in which the conservation of fuel may be accomplished. One is by eliminating all unnecessary and superfluous demands, and the other is by practicing economy in the use of the fuel for such demands are absolutely necessary.

In the matter of the heating and ventilation of buildings the principal items of unnecessary and superfluous demands are:

First: the elimination of mechanical ventilation during the early fall and late spring months when window ventilation will naturally be used anyway and may be used with almost as good success as mechanical ventilation;

Second: The cutting off of heat in corridors, stairways, courts and all such places during much of the heating season and except in coldest weather, thereby not only saving a great deal of coal, but leaving these spaces in a much more healthful and exhilarating condition;

Third: By consolidating the activities in a building so as to keep the heat shut off of all sections of same, except when actually required for use;

Fourth: By eliminating such activities as require more heat than they are worth;

Fifth: By the adjustment of the human element, so as to have the coldest natured occupants of a building in the warmest sections, so as to prevent the overheating of the whole to satisfy a few.

In our school system of about seventy schools (Newark, N. J.), the above measures are estimated to effect the following savings:

Omission of ventilation during October, November, April and May	$10,000.00
The cutting off of unnecessary heat	2,500.00
Consolidation of activities, such as evening classes and odd classes	500.00
Making a total saving for these three items of	$13,000.00

In the matter of using fuel most economically for those requirements which are an actual necessity, there are two general ways in which this may be gone about. One is to improve the economy of operation of your existing apparatus, and the other is to improve the apparatus itself, so as to make it more efficient.

The economy of operation of most any existing plant can be improved by always keeping the units in use properly proportioned to the load, keeping the fires clean and properly proportioned in thickness to the draft, keeping loads as near constant as possible and the operating conditions in keeping with the load.

In order to intelligently proportion the units of any plant to the load, it is necessary to have complete data on all consuming apparatus and to make up an estimate sheet showing their requirements for each month in the year. With such information and a system of daily reports it will appear at a glance as to whether or not the proper number of boilers, engines, etc., are being used. We are using a draft gauge and a flue-gas testing set for determining the proper thickness of fires and as to how often fires must be cleaned and shaken to produce best results.

We are using hand damper operation on all boilers in addition to automatic damper regulation in each plant for keeping the load and operation constant, as this eliminates the wide fluctuations in draft generally prevalent when the automatic damper moves from dead shut to full open.

The system adopted for the majority of our plants is as follows:

Fires are banked in one corner of

the furnace near the bridge wall and cleaned in the morning before starting by pulling all of the dead ash and clinkers out on the floor.

The live coals are then spread over a clean grate and very lightly, but evenly, covered with fresh coal. As soon as this has burned through, a heavy layer of fresh coal is spread on and this process continued until the fire is built up, as rapidly as possible, to the most economical thickness.

After this the fire is carried as near this thickness as possible and shaken often enough to keep the ash pit bright.

Fires are cleaned at noon, and again at the end of day school in every school plant.

From results already attained we estimate a saving of $7,500 from this regulation of the firing. This added to the above figures gives a total estimated saving of $20,500, which is about 25% of the total cost of fuel, and will give some idea of what may be expected in such an undertaking. This work is being handled at a cost of less than $2,000 per year.

In the matter of improving apparatus so as to make it more economical, we have gone into the question of forced draft for burning cheaper grades of coal, temperature control for preventing the waste of heat, smokeless furnaces for burning soft coal, oil burning, gas firing, and the general repairing of apparatus, such as leaky engines, valves, etc. Under present conditions it is found that, either due to the cost of apparatus or the fuel, none of the above will show anything like the results that may be expected from the same money and energy expended in bettering the operation of existing apparatus.

There is one way of improving the economy of a ventilating plant and at the same time obtaining a much more healthful and satisfactory condition and that is by graduating the temperature of the air delivered to the rooms according to outside weather conditions. There is no question in my mind but what the average inhabitant of a ventilated room is incapable of differentiating between foul air and overheated air. Also there is no question but what the relief usually gotten by opening windows or doors is due to the cooling effect of the air so admitted. There is no reason, therefore, why we should waste the coal to heat air up to a temperature that causes a room to appear foul and then to have the windows opened and cause a further waste of heat to the outside.

In order to remedy this defect we have adopted a scale of temperatures as follows:

Outside Temp., deg. F.	Temp. of entering air, deg. F.
0	70
30	66
40	64
50	62
60	60

There is another problem upon which we are working, and that is the general overheating of buildings. This consists, *first,* of actually keeping the room too warm; *second,* of opening windows instead of cutting off radiation, and *third,* of expecting rooms to be right up to temperature at opening time in the morning.

The first of these is not only wasteful of heat, but is very detrimental to health and vitality. It is one of the ways in which we, as a race, are drifting away from any of the more rugged and invigorating environments into the soft warm spots that tend to produce a soft devitalized race. Now is a good time to realize the importance of correcting this tendency and to start a strong drift in the right direction of lower and more vitalizing living and working temperatures.

The second and third are wasteful and out of all proportion as to cost for results obtained. This is a long-

drawn-out task of education, but should be dwelt upon by engineers until it is accomplished.

This was followed by a paper on "Fuel Conservation," by William M. Mackay.

Wednesday Evening Session, January 23.

Most of the session Wednesday evening was given over to the code as proposed for testing low-pressure heating boilers. The code was accepted by formal vote and thus becomes the approved practice as far as the society is concerned. The report in full, which now becomes the A. S. H. & V. E. Code for Testing House-Heating Boilers is given herewith in full:

Code for Testing Low-Pressure Heating Boilers

RULES FOR CONDUCTING EVAPORATIVE TESTS.

1. Inasmuch as the object of the test is to ascertain the amount of water evaporated per pound of coal fired, all measurements and readings should be taken in such a way as to give this result.

2. The boiler should be set up and connected to a suitable chimney flue.

3. The boiler should be thoroughly boiled out with a solution of sal soda, potassium hydrate, or sodium hydrate and then thoroughly rinsed with clean water to remove any foreign matter.

4. The piping should be connected in such a way that the steam may be carried to a point away from the boiler and piping arranged so that its condensation may not flow back to the boiler itself.

5. The separator should be attached to the flow pipe and from the bottom of the separator a pipe should be connected in such a way as to form a water seal and with an open end so that surplus water may be conducted into a pail or barrel for weighing at completion of test.

6. The piping should connect the calibrated water feeding tanks into the return of the boiler, with all necessary valves and connections, thermometer cups, etc. The water should be fed to the boiler continuously from calibrated tanks, thus showing every pound of water that enters the boiler.

7. Special care should be used in all readings.

8. Where weighing tanks are used or water is fed by gravity extra precautions should be taken to avoid error in readings.

9. Three draft gages suggested as part of the equipment, should be used to determine the pressure loss in the ash pit, pressure loss through the fuel, and pressure loss through the flues of the boiler.

10. The steam pipe from the boiler should be left open to the atmosphere so that the test can be carried on at atmospheric pressure, as we believe that running a boiler under pressure gives no more accurate results as regards capacity and efficiency than may be obtained by evaporating the water at atmospheric pressure.

11. *Starting.* It is recommended that a preliminary fire be made and the boiler run until such time as water in the boiler steams, when the preliminary fire will be dumped, the ashpit thoroughly cleaned, and air dried wood placed on the grate and kindled. The test shall be considered as starting at the time of firing the charge of wood. On this charge of wood shall be placed the coal. The wood shall be considered as having a heating value equal to 40% of that of an equal weight of coal.

The weight and temperature of the water in the boiler at the start should be recorded.

Against the boiler should be charged all of the coal and wood used during the test, and at the end of the test the boiler is to be given credit for the unburned fuel, and the quantity of water fed to the boiler during the test, less any water thrown out in excess of a quantity represented by the condensation of the pipe and separator.

12. Readings should be taken at periods not over those indicated in the log.

13. Gas analysis should be made at least every hour to get fair average results.

14. *Stopping.* When the time set for the end of the test arrives, the fire should be dumped or combustion stopped by some other method, such as spraying the fire with water. The contents of the fire pot when dumped should be placed in tightly covered cans where they may be left to cool.

After cooling, the unburned coal and ash should be separated, the unburned coal weighed and deducted from the total quantity of fuel fed to the boiler. A proximate analysis of the coal should be made in order to determine its various constituents.

RATING.

On the question of commercial rating or capacity, we have no suggestion to offer except that as a basis of comparison, the item 11 in report form appended (Fuel Available) should be calculated from area of fire box and depth to center of fire door not exceeding 20 in., less 20% for reserve, and item 12 (Time Fuel Available Will Last) figured on the basis of eight hours.

A formula for calculating rating is given by the 1913 Committee in their report and is endorsed by us in modified form as follows:

$$\frac{C \times E}{T} = \text{boiler capacity per hour in B.T.U.}$$

Where C = pounds of fuel available for one firing period;
T = time fuel available will last;
E = the total B.T.U. considered available per pound of fuel at boiler outlet, not exceeding results shown by tests.

If rating is desired in equivalent square feet direct radiation, divide capacity in B.T.U. by 250 for steam and 150 for hot water.

REPORT FORM FOR TEST OF LOW-PRESSURE HEATING BOILER.

1.—Name and catalogue ratin.....
2.—Grate surface; width...., length...., area....,
3.—Date of test.....No. of test.....
4.—Normal operating firing periods.....
5.—Duration of test.....
6.—Times fired.....
7.—Longest interval between firing.....
8.—Fuel, name.....Size.....
9.—Fuel, calorific value.....
10.—Fuel capacity pounds.....
11.—Fuel available (less re-kindling reserve).....
12.—Fuel available. Time will last, hours.....
13.—Fuel weight as fired, lbs.....
14.—Fuel moisture, per cent.....
15.—Fuel weight fired, less moisture, lbs.....
16.—Fuel weight unburned (including.. lb. recovered from ash pit)....lbs.....
17.—Fuel burned in test, lbs.....
18.—Fuel burned per hour, lbs.....
19.—Fuel burned per sq. ft. grate per hour, lbs.....
20.—Ashes, lbs.....
21.—Clinker, lbs.....
22.—Combustible, lbs.....
23.—Temperature, steam or flow, deg. F.....
24.—Temperature, feed water or return, deg. F.....
25.—Temperature, gases leaving boiler.....
26.—Temperature boiler room.....
27.—Temperature outside air.....
28.—Draft intensity in smoke pipe.....
29.—Draft intensity over fire.....
30.—Draft intensity in ash pit.....
31.—Friction loss through flue.....
32.—Friction loss through fuel.....
33.—Friction loss through inlet.....
34.—Steam pressure in boiler by gage.....
35.—Steam pressure in receiver by gage.....
36.—Percentage of moisture in steam.....
37.—Percentage of CO_2 in escaping gases...per cent
38.—Weight of water fed to boiler.....
39.—Weight of water evaporated, corrected for moisture in steam.....
40.—Equivalent evaporation from and at 212°.....
41.—Evaporation per hour of test.....
42.—Evaporation per lb. of coal as burned.....
43.—Evaporation per lb. of combustible.....
44.—Capacity, total available B.T.U.....
45.—Capacity per hour B.T.U.....
46.—Capacity total available sq. ft. radiation.....
47.—Capacity per hour, sq. ft. radiation.....
48.—Efficiency of boiler.....
49.—Efficiency of boiler and grate.....
50.—Losses, grate.....
51.—Losses, stack gas.....
52.—Losses, incomplete combustion.....
53.—Losses, unaccounted for.....
54.—Smoke pipe, size....., Length.....
55.—Chimney, size....., Height.....
56.—Draft....., Inches.....

APPENDIX

APPARATUS AND INSTRUMENTS

The apparatus and instruments used in testing should include the following:

Feed-water tanks calibrated or to be used in connection with weighing scales; air-pumps, if water is to be fed by compressed air; weighing scales for weighing fuel, ashes, etc.

Differential U-tube (with inclined leg) draft gages, at least three in number, for measuring draft tension; first, loss in draft through the fuel bed; second, loss in draft through flues.

Accurately calibrated instruments for measuring temperature of gases, water, and steam.

Steam separator for attachment to steam pipe, separator to be thoroughly covered with non-conducting material.

Blanket covering consisting of one-ply 2-lb. asbestos paper and 1-in. hair-felt which would make a desirable covering for the boiler.

Gas analysis apparatus for determining composition of the flue gases (Orsat).

Log sheets on which to keep accurate record of various readings.

The principal point of discussion before the acceptance of the report was over the method of starting and stopping the tests. Professor Breckenridge emphasized the difficulty of duplicating results with the standing start. He also found objections to the separation and weighing of the coal and ashes at the conclusion of the tests.

He also thought that better results would be secured without exhausting the steam to the atmosphere. Arthur K. Ohmes said that the code did not indicate capacities at different per-

centages of full load and that there should be some way of determining this.

P. H. Seward said that no effort was being made by the committee to rate boilers but only to determine their capacity. He said that the matter of a running or standing start was one on which all could not agree, even in the committee. He said he could see no objections to exhausting the steam to the atmosphere as provisions were made for catching the entrained moisture and it is an easy method of handling that part of the test, especially as the idea was to test only at full capacity.

In accepting the report it was voted to continue the committee to take care of any necessary revisions that might be found necessary after the code had been given a trial. In the meantime it will be used by society members as a standard method of testing the house-heating type of boilers.

A paper by Professor John R. Allen on "What We Do and Don't Know About Heating," was then presented, being read, in Professor Allen's absence, by H. M. Hart. A general discussion of the subject followed. It was voted to refer the paper to the research committee for its information and guidance.

Thursday Morning Session, January 24.

Thursday morning was devoted to warm-air furnaces.

A paper by D. Rait Richardson was presented on "The Engineer Has Opportunity in Furnace Heating."

"The Engineering of Warm-Air Furnace Heating," was then presented by M. William Ehrlich. Mr. Ehrlich laid particular stress on the vicious practice of connecting warm-air ducts into rectangular wall flues of smaller area than the ducts, as well as on the need of improving the design of these connections. He suggested that wall flues should always be made so that the width is not more than twice the depth.

It was brought out in the discussion that much more attention is being paid to furnace design by the manufacturers than formerly, but that there has been but little improvement in methods of installation.

On motion of Mr. Lyle it was voted to appoint a committee to formulate a code for testing warm-air furnaces and another code for their installation. This committee, it is thought, can work with the association of warm-air furnace manufacturers.

One speaker stated that heating engineers have not been giving proper recognition to the advances being made in furnace heating and might well be termed steam and hot water heating engineers. The appointment of a furnace code committee was given as an answer to this challenge.

A paper by G. S. Barrows was presented on "Answering Fuel Needs with a New Gas Heating System."

Answering Fuel Needs with a New Heating System.

This paper was devoted mainly to a description of the Rector system of gas heating, with some interesting comments on the development of gas heating and of the way the Rector system came to be put on the market. Numerous illustrations served to bring out the various points of this system.

Mr. Barrows stated that when first distributed, natural gas was so plentiful and cheap that it was burned as a substitute for coal in any make-shift burner in the heaters already in use. Natural gas was often piped through lines many miles long and under high pressures so that breaks in the lines occurred. As nearby gas fields became exhausted and the price of gas was raised, appliances designed for gas fuel became more common. Unfortunately, however, before their development had passed much

beyond the experimental stage, the failures of adequate supply became so frequent that natural gas companies themselves recommended to their consumers that they install only heating appliances in which solid fuel could be used when necessary.

Another point made by Mr. Barrows was that all season or general house heating does not give an ideal load factor as it makes a heavy demand on both production and distribution and produces revenue only during a part of the year. These reasons, he said, are sufficient to explain the tardy acceptance of gas for general heating of buildings. He added that this form of heating is now being extended at a gradually increasing rate. In describing Mr. Rector's inception of his gas-heating system, Mr. Barrows said:

About 1909, Alcorn Rector, while experimenting with incandescent mantle gas lamps, particularly with the view of increasing the quantity or intensity of the light as well as the efficiency of the lamp, adopted the exhaust instead of the pressure method for augmenting the proportion of primary air in his atmospheric burners. Keen and observant, he immediately saw that the heat of the products of combustion in the exhaust pipe might be utilized in a radiator for room or space heating. Tests soon showed him that with properly-designed radiation, the system would show an efficiency unknown till then and that beyond this gain, some most desirable features of ventilation, valve operation and temperature control would be possible.

For several years Mr. Rector struggled with those obstacles usually met with by the inventor of moderate means, constantly improving his system by the slow and unsatisfactory means of fault elimination in commercial installations, until about two years ago he formed a connection with a well-known company with manufacturing and commercial facilities to properly build, sell and install the system. The faults of the heating units and their parts have been overcome and improvements made in them, units of several sizes have been designed, and specifications drawn up for the installation of the radiation piping, exhaust fan, etc., for a system of heating primarily adapted for the heating of a building or one large section of a building, although it is perfectly practical to install a single radiator.

Several speakers brought up the point that the temperature of the exhaust in this system would not necessarily indicate the efficiency unless an analysis was made of the products of combustion of the gas. The danger of flash-backs was also discussed, although the fact that there is always a partial vacuum in the system would tend to prevent this and also would help to prevent gas from leaking into the room. The author was requested to furnish further data regarding quantities and costs.

James H. Davis said the Rector system of gas heating was being successfully used in Portland, Oregon, in connection with Vento heaters.

Owing to the lateness of the hour the paper on "Dust" by E. R. Knowles was presented by title.

Dust: Its Universality, Elimination and Conservation.

This paper proved to be one of the most exhaustive and carefully prepared that has been presented to the society in some time. The author began by dividing dust into molecular dust, water dust, "Scriptural" dust, just "dust," smoke dust and mechanical dust. Dusts, he said, may be injurious or inert, valuable or valueless, according to their placement or source. Dusts may be injurious by their irritant action, toxic action, mechanical action, or a combination of these dust forms. Mr. Knowles then

classified dusts under five general headings, based mostly on their reclamation value, while another classification was given of various dusts found in the air, in gases and fumes from various manufactories and as results of various manufacturing processes, which it is desirable to remove and collect.

The remainder of the paper was taken up with descriptions of various types of apparatus for dust separation, including some thirty different makes, all of which were illustrated and their important features described.

Thursday Afternoon Session, January 24.

The final session was opened with a paper by F. N. Speller and R. G. Knowland on "The Preservation of Hot Water Supply Pipe."

The Preservation of Hot-Water Supply Pipes.

The first portion of this paper deals with the principles involved in the corrosion of iron and steel in which it is pointed out that corrosion is purely an electrochemical phenomenon due to the fundamental nature of water itself, but aided by even a very minute acidity; that corrosion is promoted and made progressive and continuous by the action of dissolved oxygen in water, the gas acting as a depolizer and thereby carrying on the activity of the corrosion process; and that in domestic water, dissolved oxygen is the only depolizer or activator present, hence the term deactiavor may be applied to describe the apparatus used to remove dissolved oxygen from water.

The second portion of the paper is devoted to practical considerations of the subject, with special reference to the hot water piping in at Hemenway Terrace, Boston, where an installation was made for fixing the oxygen, similar to that described last year by Mr. Speller, at the Irene Kauffman Settlement in Pittsburgh. This process, it will be remembered, showed that by keeping hot water under pressure in contact with a large surface of iron for a sufficient length of time, it is possible to remove and "fix" the oxygen, rendering the water practically inactive or non-corrosive. The Hemenway Terrace installation was described in detail, the authors concluding that the effectiveness of this method of oxygen removal is obviously not limited to installations if steel or wrought-iron pipe, but that the life of brass or bronze pipe may also be lengthened in this manner. It was stated that the protection of a hot-water supply system by deactivation of the water should be undertaken as a matter of common precaution.

This was followed by a paper on "The Relation of Hot Water Service Heating to Various Types of Buildings."

Relation of Hot-Water Service Heating to Various Types of Buildings.

This paper is devoted to data by which heating engineers may make their own estimates for proportioning a hot-water supply, including the maximum number of gallons required per hour and the temperature rise expected. Figures are given covering the required number of hot-water fixtures for lavatories, baths, showers and slop sinks. These figures are then applied to hospitals, office buildings, shops and schools. Separate data are given for apartment houses. The proportion of storage to heating capacity is then taken up, the general rule being given that "the heating capacity should equal the constant load and the storage capacity should be sufficient to carry over the peak, plus 25% to be retained in the tank." Typical calculaions for a hot-water tank are presented, illustrated by a graphic representation of the calculations. The remainder of the

paper is taken up with data for the heating of the tanks, using steam, gas and coal, respectively, as the heating medium.

One speaker brought up the advisability of carrying higher temperatures in domestic supply water as it will reduce waste. Users, he said, will not allow very hot water to run to waste to the extent they will waste warm water. Mr. Alt said that this would have a bad effect on fixtures that would more than make up for any economies obtained in operation.

A paper was presented on "Calculations and Analysis of a Compound Gravity Low-Pressure Hot Water System," by A. J. Wells of London.

Calculations and Analysis of a Compound Gravity Low-Pressure Hot-Water System.

By a "compound" heating system, Mr. Wells means a combination of a one-pipe and two-pipe system. The one-pipe radiators are used to increase the circulating pressure and thus diminish the pipe sizes, while the two-pipe radiators are designed to prevent any excessive temperature drop in the main pipes. The author proceeds to present the calculations to determine the circulating pressure produced by the one-pipe and two-pipe systems, adding that "the calculations of the compound system are produced from these two systems." These are gone into at great length, the author concluding with the statement that "the data required for calculating the most complicated system that could possibly be designed are contained in this paper."

This paper was highly praised by Arthur K. Ohmes who called particular attention to the resistance chart based on Reitschel's experiments. This table, he said, had been used in his office successfully for many years.

The last paper presented was on "Measurements of Low-Pressure Steam Used for Heating the Buildings of the University of Michigan," by J. E. Emswiler.

For the committee on schoolhouse standards, Frank Irving Cooper made a report at this time showing the progress made in this direction. He exhibited charts indicating that the amount of space given to heating apparatus varies up to 6%, while the variations are as much as 9½% for direct heating equipment.

A resolution was passed pledging the society to co-operation in the matter of schoolhouse standards with the National Education Association.

INSTALLATION OF OFFICERS

This concluded the technical programme and was followed by the installation of officers. H. M. Hart and John F. Hale were appointed to conduct the new incumbents to the rostrum. The new president, Frederick R. Still, was warmly greeted as he took the chair and announced that he would have to depend, more than he thought when he took the nomination, on the support of the other officers. Fifty-one engineers, he said, had already been taken from his company's plant by the government.

Speaking of the needs of the society, he urged the presentation of more papers and more written discussions. He also urged more active committee work. He said the society should also take up the standardization of specifications and prepare standard forms of guarantees.

First Vice-President Walter S. Timmis was presented as the man who would have more than the usual share of responsibility of a vice-president, owing to the business handicaps of the president.

The Entertainment.

In keeping with the spirit of the times, the entertainment features were on a moderate scale, being confined largely to luncheons and theatre parties.

The society's annual dinner was held at the Hotel Astor Thursday evening, January 24, and proved one of the liveliest and most pleasurable functions of its kind the society has ever held.

The retiring president, J. Irvine Lyle, acted as toastmaster while the speakers included the new president, Frederick R. Still, Wing Tabor Wetmore, and Lieut.-Col. T. E. Powers, Canadian Engineers, who was one of the principal speakers at the society's meeting in Chicago last summer.

In presenting Mr. Still, Mr. Lyle spoke of the society's recent achievements in connection with the proposed research bureau, in its adoption of a boiler code and in starting work on a furnace code. He also referred to the service the society was rendering the government. He introduced Mr. Still as a heating engineer of international reputation.

Mr. Still said that the war was the important thing before us for the present. Many of the navy specifications were those suggested by the society's committee. The cantonment prophesies expressed at the summer meeting regarding the dangers of disease through over-crowding have come true because the recommendations of the society were not carried out.

There should be additional chapters organized at such points as Buffalo, Pittsburgh, Cincinnati, St. Louis, Denver and Seattle. We must encourage young men to join the society and he said that there were no societies in existence where a man could derive so many benefits at so little cost.

Mr. Still said it would be years, if ever, before prices go back to what they were in 1914. The war has speeded up European output to a higher efficiency than ours and after the war is over, it will be necessary for us to effect a consolidation of units,—with uniform contracts, uniform specifications and uniform design.

America, he said, is to be the Mecca of all creation after the war.

Wing Tabor Wetmore, the next speaker, proved a most delightful entertainer and presented what amounted to a series of sketches and recitations that captivated the diners. He was followed by Lieut.-Col. T. E. Powers who had many more interesting things to say regarding his experiences in the two battles of Ypres and in the battle of the Somme. He expressed the opinion that the war must be fought to a finish in order to prevent another outbreak within a few years.

Following the speech-making, the floor was cleared for dancing.

B. K. Strader, who was in direct charge of the dinner arrangements, was congratulated on all sides for the success of his plans and R. W. Pryor, Jr., the general chairman of the entertainment committee, came in for the warmest praise for his handling the entire entertainment.

America's National Fault.

Some well-expressed ideas on the subject of America's wastefulness were contained in an address delivered by Lewis E. Pierson, a prominent New York banker, before a war conference of Michigan's business men in Detroit.

"If there is one tendency," said Mr. Pierson, "which more than any other seems to menace our success in putting the nation's resources in such condition as to be able to meet the extraordinary demand which war has created, clearly it is the tendency towards national waste. Our reputation as the most wasteful nation and people in the world finds fullest justification in conditions which surround us upon every hand. Indeed, we appear to have been so impressed by nature's bountiful provision in our behalf that we have allowed ourselves to develop almost as a na-

tional characteristic a complete disregard for ordinary principles of every-day economy, which other nations have learned to include among the fundamentals of their existence.

SOLUTION NOT SIMPLE.

"Many of us appear disposed to discuss this question of national waste as though the solution were simple, and involved only a certain amount of self denial upon the part of the average citizen—as though the cutting out of luxuries in our daily life, the simplifying of the national bill of fare, the checking of extravagant tendencies in dress and in amusements would be sufficient to cover the case and serve the national purpose. Economies of this kind are vitally important and indispensable to our full success, but, after all, they represent only a very small part of what must be accomplished before this national tendency can be checked, and before more than a part of the vast wealth of this nation will be available to support our efforts in this war.

WASTE EVERYWHERE.

"Waste is everywhere—in production—in manufacture—in transportation—in purchase—in sale—in distribution. It interferes with the efficiency and proper economy of business and of Government. It is responsible for immeasurable national losses in materials destroyed—in services misdirected—in efficiency possible but not secured.

"Beginning with production—and that is the point at which Government action or correction and regulation to be fully effective must begin—we find waste. The farmer wastes when, because of careless methods, he allows grain to rot in the fields, and when because of labor or transportation or distribution difficulties of some kind, he grows fruit which never finds a market, and when he allows his cattle to reach the market in an imperfectly fattened condition, and when he tolerates land which is fallow instead of productive, and when he insists upon operating independently of his fellows instead of taking fullest advantage of the obvious benefits of co-operative organization.

UNINTELLIGENT BUYING.

"Waste is found in unintelligent buying and preparing and utilizing of materials—in money which is hoarded instead of being put into the channels of commerce for which it was intended—in commercial credit which is tied up in frozen book accounts—in the purchases of luxuries, or in extravagances which mean nothing to the purpose of war—or in the possibility of productive labor of men, or women, which is not utilized in effective manner.

GOVERNMENT WASTE.

"The Government wastes when it fixes a price so high as to permit excess profits and fails to provide a recovery tax upon the particular industry affected. It wastes when it fixes a price so low as to remove the proper incentive to the necessarily large increased production demanded by war; and it wastes when, in administering the war business of the nation, it secures from a machine, or a man, or an establishment, or a business regularly under its control, a percentage of efficiency lower than the highest efficiency of which that machine or man or establishment or business is capable; and again it wastes when, in constructing or purchasing or in any other of the war business functions with which it has been entrusted, it allows its different departments to bid against each other for labor and for vast quantities of materials and supplies, thereby creating purely fictitious values with their natural bearing upon inflation and the high cost of living, and with the disturbance to business and industry and labor which follows. It wastes when, in any form of contract, it fails to provide the incentive to economy in costs which well managed private business always is so careful to require.

COMMITTEES FOR EACH INDUSTRY.

"It would seem that nothing more quickly could secure from business its greatest value to the Government at this time than, on the one hand, the prompt organization by each essential industry, of a committee authorized to speak to the Government for the industry or questions of production, price, distribution of orders, prioity, and other matters of war importance, and on the other hand, the equally prompt creation by the Government of an organization clothed with full and properly co-ordinated responsibility and authority, which do not now exist, to direct the business operations of the war back of the forces. Such organizations to include only executives whose business capacity and experience would meet the universal approval of the patriotic intelligencies of the entire country. This organization should be charged with the duty of immediate co-ordination of the war business activities of the nation, the development of definite policies for the Government in its relations to all forms of business fundamentally related to our national interest in winning the war, and with the carrying out of such policies."

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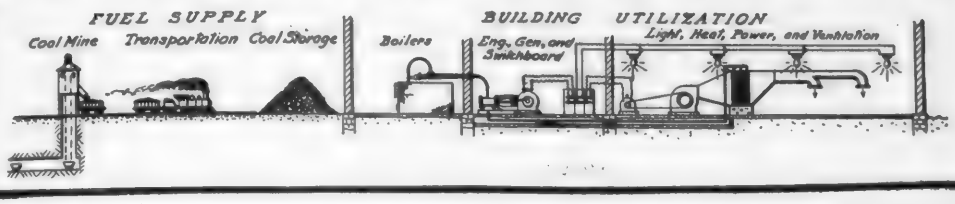
THE prospect of a heating research bureau in this country, to be conducted under the auspices of The American Society of Heating and Ventilating Engineers, and whose findings can be accepted by the public as conclusive, opens up a vista of the utmost interest to the heating profession. A good many things can be settled and taken out of the range of "claims" by this bureau. We should know, for instance, before the bureau is many years old, how to distinguish between good and bad design in various kinds of heating apparatus and appliances. New devices of exceptional merit, which now have a difficult road to follow to obtain recognition, may have their status fixed in short order. When it comes to engineering information, much of this can be standardized and this will help to eliminate the wide variations of practice that we see on all sides. If conducted properly, the bureau can give us not only the capacities of different makes of house-heating boilers, to single out one item, but their capacities at various percentages of full load, a point on which information is greatly desired. In short, the bureau has a great future before it. Broad-minded men will be needed to "put over" its findings, but in the spirit of the new day that is at hand, the undertaking has become more than possible, it has become feasible.

The details of the scheme as formulated are excellent. Dependence is not placed upon the generosity of the few, but all engineers and others interested who so desire, may have a part in the bureau's achievements. This is not the easiest way, but it is by far the most sensible. The rank and file are to pay for the work and that means they are going to see that it is properly done, without fear or favor.

Not the least important effect of the establishment of standards by so authoritative an institution is the effect this work will have on the profession itself. This, apparently has not been given a great deal of consideration. It is evident, however, that much of the aloofness and selfishness often seen among engineers is due to the fact that they believe their engineering information is theirs alone and too valuable to be given out. Their ways, they feel, are the best ways. It took them a long time to dig out their data. Let the other fellows do the same. When these men find that their carefully-cherished data and methods have become public property and are supplemented, probably, with additional information, there should be a new impetus given to the trend towards more of good fellowship and co-operation among engineers. The importance of this can scarcely be overestimated when we consider the imminent after-the-war struggle for commercial supremacy throughout the world.

POWER PLANT ENGINEERING



Selecting the Power Plant Engines

One of the most debatable points in designing a power plant for a building is the number, type, size and speed of the engines to be used and there is, indeed, much room for honest differing on this subject. Leaving the details of the various types of engines for later discussion, the number and size of the units may be regarded as the main points requiring first settlement.

As a general thing it is customary to install units of varying capacities to accommodate the different sizes of load likely to be encountered. For instance, an ordinary building may have a small day and night load from a few motors, a large night load from illumination and may, or may not, have an intermittent elevator load at all times. Indeed it does not require a very large building to employ the services of more than one elevator and this, it may be remarked, is the most difficult load to take care of in the ordinary building power plant.

The elevator motor load on starting up for direct current is usually at least 35% in excess of the rated motor capacity and for alternating current may be as high as 200%. When a generator is made two and one-half times or less of the rated capacity of the elevator motors the results are bad.

If two units are to be installed one is usually made twice the size of the other so that the small machine will carry one-third the maximum load, the large machine two-thirds and both machines together the total maximum load. With an allowable 25% overload, this means that at a pinch the smaller machine could carry 33⅓% + 25% of 33⅓% = 41⅔% and the larger machine could carry 66⅔ + 25% of 66⅔ = 83⅓% of the maximum connected load.

When three units are employed they may be rated at ¼, ½, ¾ of total load, ¼, ¼ and 1, ½, ½ and ¾ or ¼, ½ and 1.

Where four units are used they may be made ⅛, ¼, ½, and ¾ or ¼, ½, ½, ½, etc. Possibly ⅛, ¼, ¼ and 1 might work out well in some cases.

HOW GOVERNMENT FIGURES SIZES OF POWER UNITS.

The method of determining the sizes of the power units as employed by the United States Government is most interesting. As the structures in which their power plants are installed are occupied 24 hours per day, no emergency outside connection is made and to render the danger of breakdown negligible four units are generally used, these consisting of two larger generators, each able to carry the peak load, and two small units of proper size to carry the load after midnight.

It is customary in these buildings to use units of 75 to 150 Kw. capacity. The units less than 25 Kw. capacity are too small to properly carry an elevator motor load which may be suddenly thrown on and thrown off, while units of over 150 Kw. are generally too large for the ordinary building. The unit capacity is never made less than four times the rated kilowatt capacity of all the elevator motors which can be thrown on at one time.

In larger buildings where four to ten elevators may be in daily use sometimes the largest unit is split into two of equal capacity or one large unit and three of one-half its capacity may be used if conditions show such an arrangement advantageous.

SINGLE UNITS SHOULD BE SUPPLEMENTED BY EMERGENCY ELECTRIC SERVICE.

Building power plants where a single unit is used are never dependable unless emergency breakdown electric service from outside sources is put in. In such a case the unit must, of course, be large enough

to carry the whole load and this large unit must be run as long as a single watt of power is being furnished anywhere in the building unless the emergency service be cut in.

DECIDING THE GENERAL TYPE OF GENERATING UNIT.

The next thing to decide is the general type of generating unit—shall it be belt-driven or direct connected, high-speed or low-speed, direct or alternating current?

By all means avoid the belted generator in the building power plant. One of the stock arguments of the public service companies against the individual plant is the dirt, dust and *noise*. A direct connected unit is more quiet, more compact, more efficient, and has less deterioration than any belt-driven device obtainable. Moreover the engine and generator are set on the same foundation, mounted on the same (or a connected) bed-plate and are in every way more liable to keep their proper position and alignment.

Assumng that a direct connected unit is decided upon the next question is, what *type?* The engines most commonly used for such work consist of

(a) The simple, single slide-valve.
(b) The simple Corliss.
(c) The compound single slide-valve.
(d) The compound Corliss.
(e) Uniflow engine.
(f) Buckeye-Mobile.
(g) Gas and oil engines.

At 100 lbs. initial gauge pressure the steam consumption in pounds per hour per I. H. P. for the various types approximate the following:

	25	50	75	100	125
(a)	40.5	33.4	30.9	30.6	31.1
(b)	34.8	26.4	24.8	25.3	26.4
(c)	48.6	32.9	28.2	27.5	28.0
(d)	47.0	32.3	26.7	25.2	24.9
(e)	19.7*	19.3*	19.5*	20.0*	....
(f)	....	....	12.9**	13.3**	....

* = Initial gauge pressure of 136.4 lbs..
** = Initial gauge pressure of 208 to 210 lbs., with 171° to 192° F. of superheat.

CHARACTERISTICS OF VARIOUS TYPES OF ENGINES

A general outline of the characteristics of the various classes may be summed up in the following brief statements:

Class A is simple to operate, easy to keep in order, has few parts and is low in first cost.

Class B is more complicated, is used where higher grade operators can be secured, costs more but is less expensive to operate.

Class C is usually run condensing and on higher steam pressures; while giving greater economy than Class A, is also more expensive and complex.

Class D is suitable for larger sizes, at higher steam pressures, usually runs condensing, and is the most complicated and costly of the first four classes.

Class E seems to be a particularly desirable type of engine for steam economy

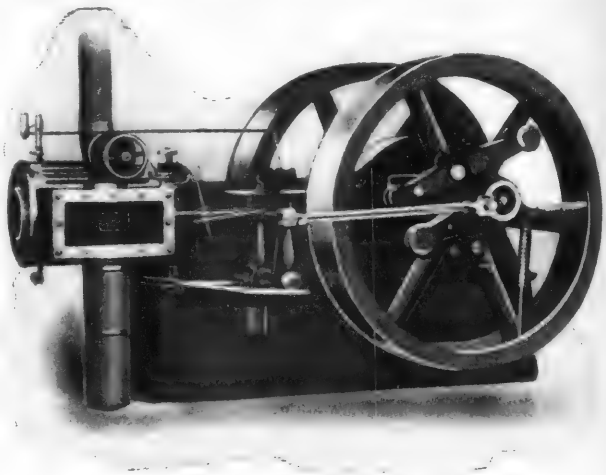


FIG. 1—SIMPLE ENGINE.
(Bound Brook Engine & Mfg. Co.)

and varies its consumption but little at various fractions of full load. This type is a modification of the European engine which runs condensing, and is made by only a very few manufacturers in this country.

Class F is a self-contained unit involving the mounting of the engine on top of the boiler (somewhat after the manner of the railroad locomotive, but inverted) and employs superheated steam.

This subjects the engine to—of necessity—being located in the boiler-room, with its accompanying dust and dirt, and does not

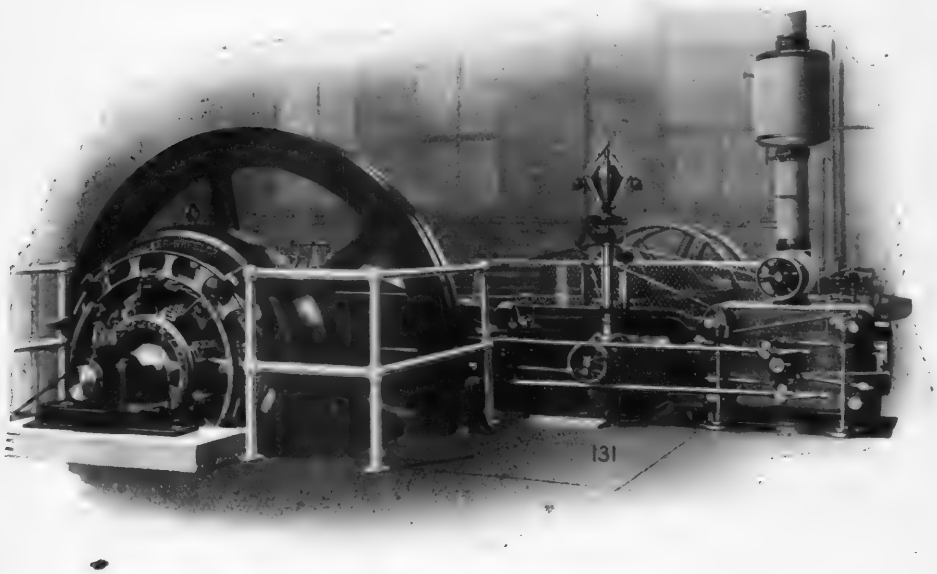


FIG. 2—SIMPLE CORLISS ENGINE.
(Vilter Mfg. Co.)

provide the engine and generator with the heavy masonry foundation obtained in all the other installations. While used to a considerable extent in factories this arrangement cannot be recommended for public buildings.

Class G is not recommended on account of the dangers attending the handling and storage of gas and oil fuels.

HIGH EFFICIENCY NOT NEEDED WITH EXHAUST STEAM HEATING.

If the exhaust steam from the engine can be utilized throughout the winter—or, better yet, all the year round—there is, indeed, no particularly great saving to be made by installing a highly *efficient* engine. For the *more* the engine takes out of the steam and transforms into *work*, the *less heat* there is left in the exhaust for heating; and the fewer number of pounds of steam *used* by the engine the *less* exhaust there is to utilize and the bigger the amount of makeup steam supplied from the boiler through the reducing valve.

It is quite a question whether engineers have not for a long time been working on the wrong end of the steam problem and, instead of expending their energies in cutting down the steam consumption of the steam engine, whether they should not have devoted their endeavors to more efficiently utilizing the exhaust.

At a vacuum of 29.5 (which is much higher than can ever be obtained in practice) a pound of steam contains a total of 1083 B. T.U., while at 100 lbs. gauge it contains 1189 B. T. U., showing that a perfect engine could not utilize more than 1189—1083 = 106 B. T. U. unless part of the steam is condensed—which really is the case to a small extent. Thus, with the exception of this small amount of engine condensation,

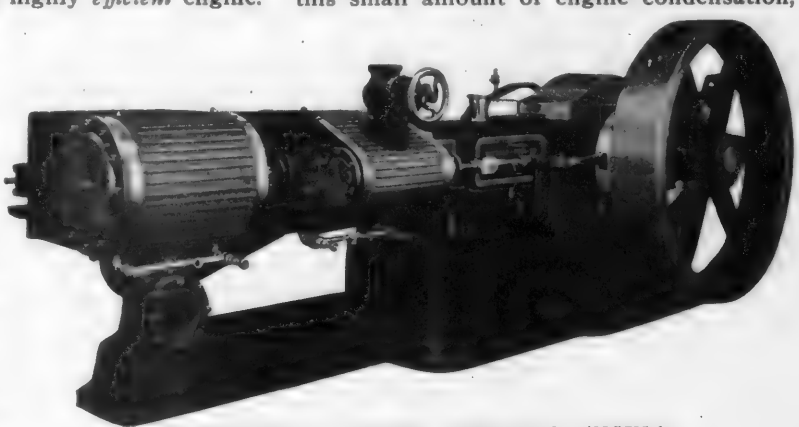


FIG. 3—HORIZONTAL TANDEM COMPOUND ENGINE.
(Buffalo Forge Co).

it is impossible to ever utilize much over 106/1189 or about 9% of the heat in the steam; with higher steam pressures possibly as high as 15% may be utilized, but this is probably the limit.

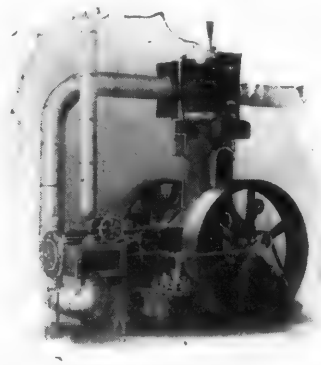


FIG. 4—ANGLE COMPOUND ENGINE.
(Bound Brook Engine & Mfg. Co.)

Thus the heating and ventilating engineers who are utilizing the exhaust steam in useful and necessary heating work are laboring in a much more fertile field than can ever be developed on the engine end. They are handling 85% to 95% of the B. T. U. obtained from every pound of coal burned while at the best the steam engine can never use over 15% and some do use as low as only 5%.

From this it can be seen that the use of condensing engines—which throw away in the condenser water about 90% of the heat they receive in the steam—are not desirable in a combind heating and power plant, which all power plants should be. If a summer use for exhaust steam—such as for refrigeration and air cooling work—can be developed this argument assumes even greater force. This, then, leaves the matter that for such combined heating and power installations the simplest—and, fortunately, the cheapest—type of unit to use is the *best* almost *regardless* of its economy. Such a unit is covered by the engines embraced in Class A.

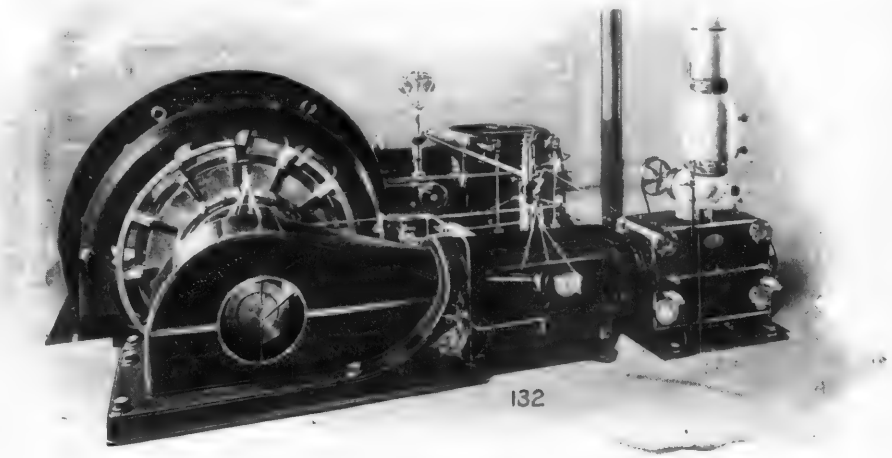


FIG. 5—CROSS-COMPOUND CORLISS ENGINE.
(Vilter Mfg. Co.)

LEGAL DECISIONS

Unprotected Steam Pipe

The owners of a steam-heated apartment building failed to place a tap upon the open end of a radiator pipe in an apartment after removing the radiator therefrom in the spring, although the attention of the owners' foreman and of the janitor of the building was called to the matter. In consequence thereof when steam was turned on in the building in the fall during the absence of the tenant of the apartment, his property was damaged by steam which issued from the unprotected pipe. It was held in an action for damages by the tenant, that the unprotected condition of the pipe was the result of a positive wrongful act on the part of the owners' employees. The provisions of the lease exempted the owners from liability for any damage occasioned by steam and water pipes, "ex-

cept from the positive wrongful act of the lessor herein or his employees." It was held that a verdict for the plaintiff was sustained by the evidence. *Dickey* v. *Wells,* 203 Ill. App., 305.

Workmen's Compensation Law—Installation of Heating Apparatus

In a proceeding under the New York Workmen's Compensation Act for personal injuries the claimant was the superintendent of an apartment house, and part of his duties was to make such repairs as he could and operate the boilers which supplied the steam heat to the premises. He went into the storeroom in the basement to obtain a radiator to be put in an apartment in place of one which was complained of as cold. In lifting the radiator it fell and crushed one of his toes. Was the employee at the time of injury engaged in any employment or work covered by the Compensation Law? Group 42 of section 2, as it existed in January, 1916, specified "plumbing, sanitary or heating, engineering and covering of pipes or boilers." The lifting of a radiator to connect it up for heating purposes was not heating engineering nor the installation and covering of pipes or boilers. That such work was not included within these terms is evident from the amendment to the law passed subsequently and in the same year. Laws 1916, c. 622, Group 42, was, amended so as to read "plumbing, sanitary lighting or heating installation or repair"; and the word "engineering" was dropped. So, too, group 22 was amended by the same act to include "heating and lighting." The words "maintenance and care of buildings" were not added to group 42 until 1917. Laws 1917, c. 705. *Kammer* v. *Hawk,* New York Court of Appeals, 117 N. E., 576.

Regulation of Foreign Corporations

The Michigan Supreme Court holds, *B. F. Sturtevant Co.* v. *Adolph Lettelt Ironworks,* 163 N. W., 13, that where a ventilating system which a foreign corporation sold and agreed to install in a school building had no such intrinsic or peculiar quality or inherent complexity as to require an agreement to install in order to effect sales generally, the contract was not within the exception in favor of interstate commerce contained in the Michigan statute of 1907 prescribing the conditions on which foreign corporations may be admitted to do business in the state.

Architect's Certificate.

In mechanic's lien proceedings by a subcontractor, the architect's certificate, made pursuant to a contract provision, that the owner did not owe the general contractor, is conclusive in the absence of fraud. *Maddux* v. *Buchanan,* Virginia Supreme Court of Appeals, 92 S. E., 830.

Necessity for Franchise and Consent of Commission.

The New York Public Service Commission holds, *Re Collins Light, Heat & Power Company,* Case No. 5749, that a light, heat and power company cannot lawfully operate in a town in New York State until a franchise has been granted it by the authorities and permission given by the commission to proceed thereunder; and that permission should not be granted a public utility to make extensions in such a way as to prevent another corporation from making any further developments in territory naturally tributary to it.

It also holds, *Colliers Light, Heat & Power Company,* v. *Oneonta Light, Heat, & Power Company,* Case No. 5672, that such a company cannot, without the consent of the commission, extend operations into an adjacent municipality in which it has no franchise, even if it may do so without occupying the public highway.

CORRESPONDENCE

Another Garage Heating Problem.

EDITOR HEATING AND VENTILATING MAGAZINE:

I wish to heat with hot water—ordinary two-pipe gravity system—a residence of say 1,000 sq. ft. of radiation (and also a garage some 25 to 40 ft. away) with the same apparatus. I should like to know the best way of running the feed and return pipes which shall be 3 ft. below grade between the two buildings; the basement floor is 4 ft. below grade and the radiation in the garage about 200 sq. ft. The boiler is about 25 ft. from nearest wall to garage. Should the garage be supplied from an opening in the boiler or header for itself? May it be taken from the end of a main? Is there any advantage in running a special riser to the top floor of residence,

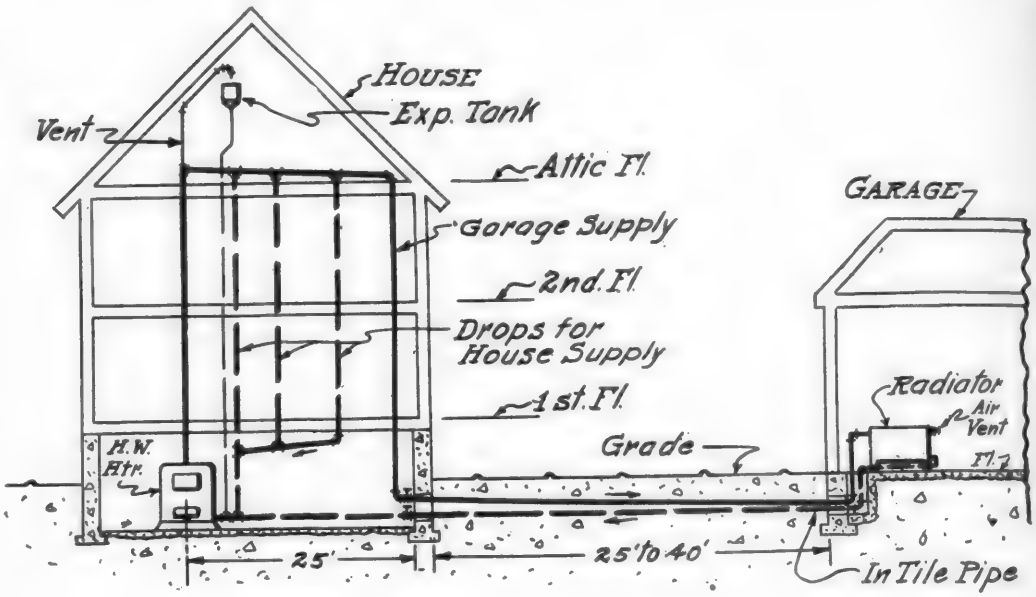


FIG. 1—CONDITIONS OF GARAGE PROBLEM.

then venting it, and running it down to basement and thence to garage. A. F.

Chicago, Ill.

Our correspondent is on the right track when he speaks of carrying the supply to the garage up to the top floor of the residence before attempting to take it across to the garage. In fact, this is the only way in which he will secure successful circulation.

As nearly as can be ascertained from his letter the conditions exist about as shown in Fig. 1, and it is suggested that, to facilitate the combined installation, the down-feed system be used in the residence. This means that all the hot water is carried to the top of the house in one main riser, as shown in Fig. 1, the top of the riser constituting the highest point of the circulating system, this high point being vented by the vent line carried up and turned down over the expansion tank.

The feed main for the house slopes downward constantly from this point to the various drops supplying the house radiators and to one separate drop for the garage—no house radiator connections being made to this drop. The drop is carried as straight down as possible to the level where it leaves the house to cross over to the garage.

This cross-over should be laid in tile pipe to protect the covering on the hot-water lines and to allow proper expansion, the supply line being graded down toward the garage and the return line down toward the house. In the garage, rise up and connect to one or more radiators as shown, avoiding all pockets in the piping and providing for the relief of the air collecting in the top of the garage radiator by a small air vent, as shown. It may be found easier if each pipe to and from the garage is laid in a separate 6 in. tile line so as to facilitate the grading of same.

In the *house* the house drops are usually made as shown in Fig. 2, the supply drop diminishing in size as the various radiators are taken off from it and the return drop increasing in size as the returns from the various radiators are received into it. In

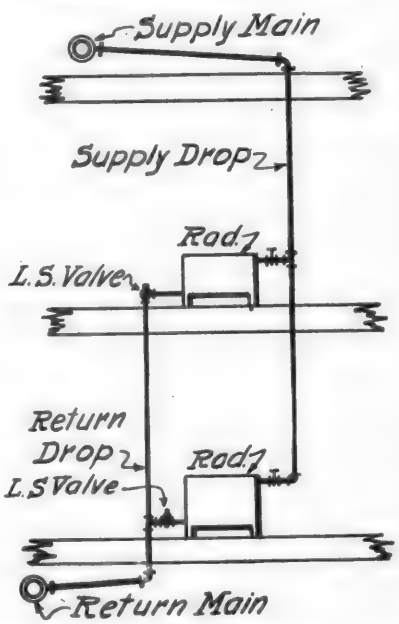


FIG 2—USUAL ARRANGEMENT OF HOUSE DROPS.

good work on the return from each radiator a lock-shield valve is installed for the purpose of adjusting the flow between the various radiators so that one will not rob the circulation to another. In this way accurate adjustment can be secured and, owing to the radiators being vented through the supply line, no air vents are necessary.

The two valves shown controlling the supply and return from the garage just inside the house wall should have 1/8 in. or 3/16 in. hole drilled through the gates so, even if closed to keep the radiators cool in a garage, there would still be enough circulation through them to prevent freezing upon a sudden change in the weather.

If the construction of the house does not permit the use of the overhead main the scheme shown in the corresponding column of THE HEATING AND VENTILATING MAGAZINE for January, 1918, is also recommended for this case.

Back Draft in Chimney

EDITOR, HEATING AND VENTILATING MAGAZINE:

In THE HEATING AND VENTILATING MAGAZINE for December, 1917, under the caption of "Back Draft in Chimney," there is a question from a correspondent as to the cause and remedy of down draft in one of three flues built together. The conditions are: two outside chimneys on opposite sides of a dwelling (two-story and basement) with an open fireplace on each floor. One of these chimneys has but one flue and this connected to a hot-water boiler in the basement; the other has three flues each connected to a fireplace. The one to the basement and, therefore, the longest, has a down draft, while all the others have good draft. Radiation in the basement is hung on the ceiling and the down draft tends in the direction of an open stairway extending to the upper floors. There is also a perceptible flow towards a door which opens into the boiler room. Opening the outside boiler room door does not remedy the difficulty.

In the reply to the correspondent sketches are shown and various suggestions are offered. By the process of elimination and quoting from certain paragraphs, we may dispose of these as follows:

"The correspondent displayed good reasoning in trying the experiment of opening the outside boiler-room door 'D' but if this door happened *at that time* to be on the lee side of the building it might have made conditions worse instead of better. With the wind blowing *against* the boiler-room side of the house it is thought that no trouble will be experienced with this flue, especially if the doors between Room A and the boiler room should be left open."

"Third, the air supply for the boiler must be taken to a great extent out of the basement, there being but one door and window in the boiler-room which would hardly provide sufficient leakage to supply the necessary air for combustion."

"Also look into the matter of making the boiler-room door fairly air tight and, if necessary, place a small register face in the outside door panel of door 'D' to supply the air necessary for combustion."

It is apparent that the suggestions made in the last paragraph would not be effective if the conditions as outlined in the first paragraph exist. The correspondent also stated that he experimented by opening the outside boiler room door. It is evident that the wind does not blow on the boiler room side of the dwelling.

Your reply also states:

There are several features shown in our correspondent's sketch which might help to produce the back draft in the chimney flue as described. In the first place, the chimney is an outside one with one side and two ends exposed to the outer temperature, which will, of course, have a tendency to cool the flues and cause a reverse draft unless heat is supplied at the bottom more rapidly than it is radiated on the way up.

In the second place, the other flues in the same chimney are all connected to fireplaces which are undoubtedly used only intermittently, resulting in the chimney getting very cold and so reducing the temperature of the air in the flue that its weight becomes greater than the air in the house thus producing a reverse draft. * * * In conclusion, it might be said the reverse drafts in outside chimneys from fire-places are rather common due to the chimney getting chilled between times when the fire-places are out of use.

The comments in the above paragraphs in regard to intermittent operation and cooling surfaces are applicable to all three fireplaces and flues. As the same conditions applying to the reversed flue are present also with those of good upward draft, this does not appear to afford a satisfactory explanation of the difficulty. However, there is, in this respect, a partial explanation. The two flues with good draft, being from fireplaces on upper floors, have less lineal feet of frictional surface, less exposure to the outside air and wind to cause cooling of the flues and a less height of column for air if it does become cold due to intermittent operation. Of the upper two flues one is located between two others, therefore two of its sides are protected from cooling by air in motion or otherwise, but

it may be affected slightly by cooling on one side from the reversed flue currents. The flue from the topmost floor has the same exposure as the reversed flue, with the exception that its height is the shortest of all the flues, and one side is next to a hot flue. However, some of the advantages obtained, as outlined by the flue sides being next to the other hot flues, will not be present if the upper fireplaces are not in continuous use. In this connection, it may be that the fire in the basement fireplace is intermittent, whereas the others, being in upper living rooms, are practically continuous.

"As near as can be judged from the sketch, the most satisfactory solution of the trouble will probably be found in providing a ventilator top of the positive suction type and connected to the reversed flue alone."

This is one remedy providing the suction action of the ventilator is more powerful than the opposing currents in the stairway and the wind is always blowing. The ventilator would act as a check valve and prevent a downward flow of air, but it still must oppose the action of upward currents in the hall shaft and overcoming these produce its own draft. The ventilator might effect the same results as a closed damper in the flue, no down draft and no up draft.

"It is not thought that the correspondent's suggestion of capping all the flues at the top into a contracted opening, as shown in Fig. 2, will give any relief. The usual result of such procedure is the pulling down of the smoke from the other flues into the reversed flue resulting much more disagreeably than when only cold air is drawn down as at present."

The above is true if the down draft is powerful enough to pull the heated gases and smoke from one or both of the other two flues downward with it. Heated air does not readily flow downward and should this occur there would no longer exist any down draft of any strength for the column of cold air in the flue has then been replaced by one of fairly high temperature having a tendency to rise.

"It is not likely that the radiators placed on the ceiling of the basement will affect the matter at all."

The writer believes that an error has been made in thus disposing of this phase of the situation. The air, being heated at the ceiling, will remain at that point, as it is well-known that ceiling radiators affect one's head annoyingly by radiation and that except where there is machinery in motion, cranes, etc., as in industrial plants, there is no air circulation and effective heating. This is due to the natural law of gravity. In this instance, the heated air from the many coils has a strong tendency to rise and, traveling along the ceiling, leave the various rooms through exits as afforded by openings at tops of doorways, or by transoms, if there are any. If the radiators were on the floor, the heated air would tend to rise up the fireplace, assist the draft and maintain the flue temperature. As it is, the heated air takes ready advantage of this line of least resistance and, being unrestricted, rises and finds no ventilators or upper outlets for escape except that afforded by the open fireplaces on the upper floors.

Tenants on upper floors usually leave their doors to inner halls open, thereby heating their rooms. Many a five- or six-story building has been heated uncomfortably at the top due to elevator or stairway shaft causing powerful up drafts, and it is for the elimination of odors that kitchens in modern hotels and department stores are located on upper floors.

As to the flue from the hot water boiler, this being in continuous use remains well heated. It also affords passage for high-temperature gases, which would arise from a grate of large area having a comparatively high rate of combustion. When the correspondent opened door "D" possibly he did not note whether the air continued to travel under the doorway to the boiler room flue, this having the strongest draft of all flues, except the stairway shaft considered as a flue.

In regard to the intermittent use of open fireplaces, it is sometimes difficult to heat up a radiator once it becomes cold. Though from different causes, still it is so with heated air. Once it is started along a well-defined course, it generally continues in that direction. A new or green chimney, especially in cold weather, will never have a perfect draft until it becomes perfectly dry which sometimes requires three or four weeks.

As to remedies, eliminating the ceiling radiation and substituting floor radiation is out of the question except possibly in Room "A." However, the correspondent could shut off steam to the coils in this room or in all rooms and note the results, or again he could install a small register or grille in the reversed flue at the ceiling line. This would serve as an outlet for the air which, heated by ceiling coils, will not drop to the fireplace opening, although it would waste the heat of these coils. A gas jet located a few feet up the flue and burning prior to starting the fire might be of help. However, taking the trouble at its source, why

not tightly seal the doorway leading from Room "A" and provide necessary air from the window in this room. Further, the openings around doors of rooms in the upper floors, or even that to the boiler room, could be tightly closed so that the tendency for down draft would cease.

New York. T. W. R.

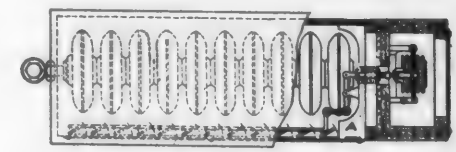
New Methods in Temperature-Control Practice.

In a recent issue of THE HEATING AND VENTILATING MAGAZINE a correspondent called attention to the fact that while large buildings are equipped, during construction, with an automatic heat-regulating system, such as the well-known methods of compressed-air control, such systems are rarely installed in old buildings, because of the cost and inconvenience which would result from the tearing up of floors and plaster in order to lay the air pipes.

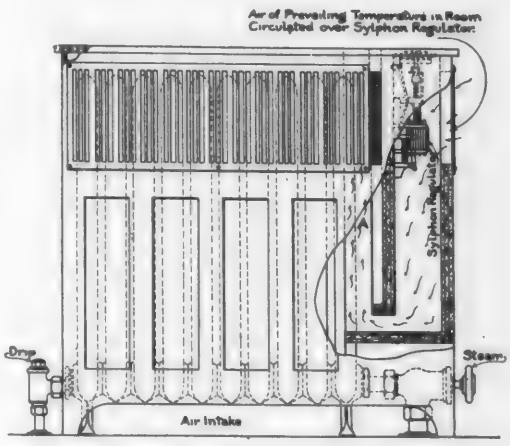
In reply to this correspondent it was pointed out that several methods of individual radiator control have been developed within recent years. In addition to those mentioned, one of the most interesting individual unit-control systems has been brought out by the Fulton Company, of Knoxville, Tenn., under the name of the "Ja-Nar." This system makes use of a radiator covering made of pressed steel, equipped with louvres which are under the control of a thermostat placed in the room and as near the radiator as may be desired. This system constitutes a separate and selective method of room heat regulation for buildings equipped with direct steam or hot water systems, at the same time fully concealing the radiator, as the covering is paneled and finished in grained or plain baked and polished enamel.

When used with this method of heat-regulation, the thermostat is placed directly in the current of the inflowing room air, as shown in the sketch. Being set to expand at rising temperatures between 60° and 70° F. and conversely, to contract on lowering temperatures between these limits, the thermostat travels forward or backward as the incoming air strikes upon its surface and operates to open or close a series of louvres which extend across the front of the covering. When these louvres are open, circulation of air by induction is at once established from the main air inlet at the base of the covering, and heating of the room by convection follows.

When the room temperature rises to the desired degree the thermostat will attain its normal position, causing the louvres to close and stopping the circulation of air over the coils. It is stated that a temperature regulation to within 2° can be obtained in this manner.



Half Plan & Section



Front Elevation Showing Operating Device

ARRANGEMENT OF TEMPERATURE CONTROLLING MECHANISM IN JA-NAR RADIATOR CABINET

One of the notable results of this operation is the effect on the enclosed air when the louvres are entirely shut. The flow of air over the radiator at once ceases with the result that the air within the enclosure attains practically the temperature of the steam so that condensation ceases.

Daylight Saving Bill Before Congress.

The severity of the present winter in most sections of the country has given an impetus to the agitation in favor of the passage of the daylight saving bill, now pending in Congress. Twelve European countries, including England, France, Germany, Austria-Hungary and Italy have adopted this plan, as has also Australia. As is well-known, the plan proposed in the bill is to turn the hands of the clock ahead one hour.

America's Coal Crisis

Heating engineers are familiar with the course of recent events in connection with the coal-saving orders issued by the national fuel administration. How the Monday holidays, running from January to March 28, affect office buildings is illustrated by the accompanying announcement affecting the building in which THE HEATING AND VENTILATING MAGAZINE is located in New York.

IMPORTANT NOTICE

Until further notice this building will be operated in strict accordance with the orders of the **National Fuel Administrator.**

On Mondays
Beginning January 21, 1918

there will be no heat, elevator service or light supplied, except as follows: that which is absolutely necessary for the protection of the building, and to such occupants as are permitted by the order to have such service.

The building will also be operated in strict accordance with orders of the **Fuel Administrator of the State of New York,** as follows:

OFFICE BUILDINGS

1. No live steam will be used for heating between the hours of 7 P. M. and 7 A. M. on each business day.
2. No live steam will be used for heating on Sundays and holidays.
3. Electric lighting to be cut down at least 25%.

Exception: Live steam may be used during the above restricted hours only for the protection of the property

STORES, LOFTS AND MERCANTILE BUILDINGS

1. No live steam will be used for heating between the hours of 6.30 P. M. and 6.30 A. M. on each business day
2. No live steam will be used for heating on Sundays and holidays.
3. Electric lighting to be cut down at least 25%
4. Interior show window lighting shall be discontinued after 7 P. M., excepting such lighting as is necessary for the protection of the property

Exception: Live steam may be used during the above restricted hours only for the protection of the property

CRUIKSHANK COMPANY, Agent
141 BROADWAY NEW YORK CITY

TYPICAL NOTICE POSTED IN NEW YORK OFFICE BUILDINGS.

THE ACTION TAKEN IN BOSTON

The action taken in Boston just previous to the shut-down order of Dr. Garfield is of more than passing interest. This order was issued by James J. Storrow, fuel administrator for New England, on January 9 and went into effect at once:

"Office, banking and other business buildings shall not be heated on Sundays and holidays or on Saturday after 12 noon, or on other days after 5 p.m., except sufficient to prevent freezing. No elevator service shall be given on Sundays, holidays or between 6 p.m. and 7 a.m. on other days.

"All wholesale, retail and other business houses and stores shall open at 9 a.m., and close at 5 p.m., for doing business with the public, with the following exceptions: Dry goods, department, clothing and variety stores whose regular practice has been to remain open after 7 p.m., one or more evenings a week, may remain open until 10 p.m. on Wednesdays and Saturdays. Other retail businesses, whose regular practice has been to remain open evenings after 7 p.m., shall close not later than 10 p.m. Pharmacies may remain open after 10 p.m., but shall not use electric light exceeding a total of 100 watts after 10 p.m. Markets and grocery stores may remain open until 10 p.m. on Saturdays and until 6 p.m. on other days.

"Theatres, motion picture houses, bars, bowling alleys, billiard halls, public and private dance halls and all places of amusement shall close at 10 p.m. Theatres and dance halls may open earlier than usual.

"Every night except Saturday shall be a 'lightless night.' 'White Way,' cluster or other decorative street lighting is forbidden.

"These orders shall not apply to government work, and further exceptions to them may be granted in cases of public necessity.

"It is also recommended:

"That the business for the day end at 5 p.m. and evening activities end at 10 p.m.; many public institutions desirable under ordinary condition should be closed and others curtailed; schools should be put on a one-session basis as far as practicable.

"Factories should arrange their hours to save daylight and to relieve peak load. Salaries and wages should not be reduced on account of these orders and recommendations."

THE GARFIELD SHUT-DOWN ORDER

The principal requirements of the Garfield shut-down order are also presented herewith to give our readers a permanent record of a situation that will probably not arise again in the lifetime of the present generation:

Until further order of the United States Fuel administrator, all persons selling fuel in whatever capacity shall give preference to orders for necessary requirements:

A—Of railroads;

B—Of domestic consumers, hospitals, charitable institutions, and army and navy cantonments;

C—Of public utilities, telephones and telegraph plants:

D—Of ships and vessels for bunker purposes:

E—Of the United States for strictly governmental purposes, not including orders from or for factories or plants working on contracts for the United States;

F—Of municipal, county or state governments for necessary public uses;

G—Of manufacturers of perishable food or of food for necessary immediate consumption.

The order further provided that on January 18, 19, 20, 21 and 22, 1918, no fuel should be delivered to any person, firm, association or corporation for any uses or requirements not included in the foregoing list until the requirements included in the list should have been first delivered.

On January 18, 19, 20, 21 and 22, 1918, and also on each and every Monday beginning January 28, 1918, and continuing up to and including March 25, 1918, no manufacturing plant shall burn fuel or use power derived from fuel for any purpose except—

A—Such plants as from their nature must be continuously operated seven days each week to avoid serious injury to the plant itself or its contents.

B—Manufacturers of perishable foods.

C—Manufacturers of food not perishable and not in immediate demand, who may burn fuel to such extent as is authorized by the Fuel Administrator of the State in which such plant is located or by his representative authorized therefor, upon application, by the United States Food Administrator.

D—Printers or publishers of daily papers may burn fuel as usual excepting on every Monday from January 21 to March 25, 1918, inclusive, on which days they may burn fuel to such extent as is necessary to issue such editions as such papers customarily issue on important national legal holidays, and where such papers do not issue any editions on a holiday, they are permitted to issue one edition on the said Mondays.

E—Printing establishments which were allowed to burn fuel on January 18, 19, 20 and 22, to the extent necessary to issue current numbers of magazines and other publications periodically issued.

On each Monday, beginning January 21, 1918, and continuing up to and including Monday, March 25, 1918, no fuel shall be burned, except to such extent as is essential to prevent injury to property from freezing, for the purpose of supplying heat for:

A—Any business or professional offices, except offices used by the United States, State, county or municipal governments, transportation companies, or which are occupied by banks and trust companies or by physicians or dentists.

B—Wholesale or retail stores, or any other stores, business houses or buildings whatever, except that for the purpose of selling food only, for which purposes stores may maintain necessary heat until 12 o'clock noon, and for the purpose of selling drugs and medical supplies only, stores may maintain necessary heat throughout the day and evening.

C—Theatres, moving picture houses, bowling alleys, billiard rooms, private or public dance halls, or any other place of amusement.*

On the above specified Mondays, no fuel shall be burned for the purpose of heating rooms or buildings in which liquor is sold on those days.

No fuel shall be burned on any of the foregoing specified Mondays for the purpose of supplying power for the movement of surface, elevated, subway or suburban cars or trains in excess of the amount used on the Sundays previously thereto.

The order provides that nothing in this order shall be held to forbid the burning of fuel to heat rooms or such portions of buildings as are used in connection with the production or distribution of fuel.

The State fuel administrators are authorized by the order to issue orders on special applications for relief, where necessary, to prevent injury to health or destruction of or injury to property by fire or freezing.

The order is effective in all of the territory of the United States east of the Mississippi River, including the whole of the states of Louisiana and Minnesota.

* The closing day for this class of buildings was changed to Tuesday.

The War and the Heating Engineer

Illinois State Council of Defense Issues Heating Rules.

A 4-page circular has been issued by the Illinois State Council of Defense, containing abstracts of the recent bulletin published by the Engineering Experiment Station of the University of Illinois on "The Economical Purchase and Use of Coal for Heating Homes." The rules are given with special reference to conditions in Illniois. Among other things the bulletin states:

No system of heating can be economical unless a careful inspection of the building is made and every precaution taken to prevent the entrance or inleakage of cold air around the windows and doors, especially those on the windward sides. Whenever cold air leaks into a house an equivalent volume of warm air leaks out, and the heating plant must make up this loss of heat.

In frame buildings the outside walls should not only be air-tight, but the air spaces between the studs should be completely closed off at the basement and at the attic, so that air currents cannot pass up through these spaces.

Under "Operation of House Heaters" it is stated:

(1) Heating surfaces should be kept clean and free from soot and ash accumulations, and the entire ash-pit should be cleaned daily.

(2) Grates should be true and not warped, should move easily, and should have no broken places for coal to drop through. Unburned or partly burned coal should not appear in the ashes at any time.

(3) The fuel pot should be kept full with fire surface at the level of fire door; let ashes accumulate on (not under) the grate in mild weather. Grates should not be shaken too long nor violently; and clinkers should be removed with as little disturbance of the fire as possible. *Do not shake or disturb a very low fire until you have added and ignited a little fresh fuel.*

(4) Anticipate the heating demand by firing promptly when the outside temperature *begins* to drop, or the wind increases, Do not allow a fire to burn too thin nor to develop holes in the fire bed.

(5) If the heater is small for its work, do not use coal containing a large amount of fine material.

(6) The house should be kept at a uniform temperature and should not be allowed to cool down more than ten degrees at night.

(7) The temperature of all rooms should be as low as is consistent with comfort. To heat a house to 75° F. instead of to 70° F. with an average outside temperature of 40° F. for the entire heating season means a 17% increase in fuel consumption.

Wood Versus Coal.

The United States Fuel Administration in co-operation with the Departure of Agriculture has inaugurated an intensive campaign for the substitution of wood for coal. The action is taken as a means of conserving the coal supply and experts from the fuel administration estimate that the utilization of the nation's vast available wood supply would go far toward meeting the shortages of 50,000,000 tons in the nation's coal supply.

In this connection it is announced that the Department of Agriculture will provide the services of expert foresters who will supervise cutting of wood so that no damage may be done to growing timber and that the largest use may be obtained of the supply of wood.

One cord of hard wood is equal to a ton of coal, according to the experts of the fuel administration. One ton of coal is released for use in war work for every cord of wood substituted. The Department of Agriculture and the fuel administration have statistics showing that there is a vast quantity of dead wood in many sections of the country and that the supply of wood in many communities is sufficient for domestic purposes in those parts. This wood in many instances is destroyed as waste and its conservation would not only serve the patriotic purpose of conserving coal needed to win the war but will also prove a measure of economy to the users.

Needs of U. S. Public Service Reserve.

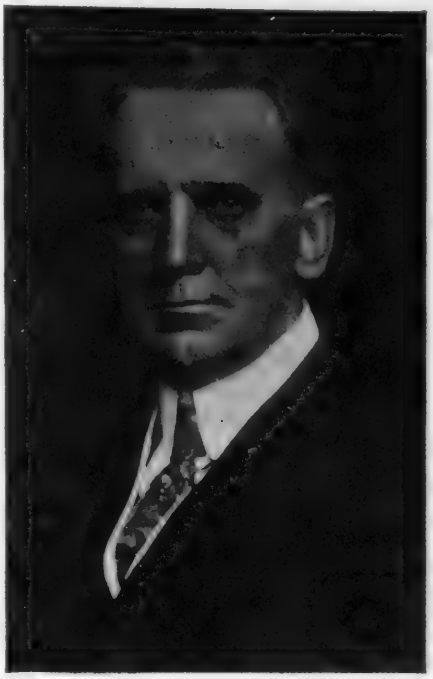
The army and navy staff departments continue to need men of engineering experience, especially in industrial lines, says an announcement made by Henry N. More, publicity director of the United States Public Service Reserve, in Washington. At present the outlook is that the demand will continue throughout the period of the war. The reserve keeps on file the records of men willing to serve when called and points out that this service enables one to keep in touch with his own profession while, at the same time, he becomes a commissioned officer. It is also pointed out that the service is usually in the United States.

Opportunities for Civilian Workers in the Ordnance Department.

Several thousand civilian workers are called for, in addition to those secured up to date, for service in the Ordnance Department, in Washington. The United States Civil Service Commission is conducting an extensive campaign to obtain this needed help. Among the clerical positions open are the following: 2,000 stenographers and typewriters, men and women, $1100 to $1200 a year; 2000 typewriter operators, men and women, $1100 to $1200 a year; 200 general clerks, men and women, $1100 a year; 500 index and catalogue clerks, men and women, $1100 to $1200 a year; 200 clerks qualified in business administration, $1200 to $1500 a year; 300 schedule clerks, men and women, $1400 to $1600 a year; 300 production clerks, not more than $1500 a year; 100 statisticians, $1800 a year; 100 multigraph operators, men and women, $1000 to $1200 a year. There are also wanted 200 engineers of tests of ordnance material, $1500 to $2400 a year, an equal number of assistant engineers; also 500 mechanical draftsmen, $800 to $1800 a year; 50 gauge designers, $2000 to $3000 a year; and 100 apprentice draftsmen, $480 a year. A large number of inspection positions are also open.

Heating Men in Military Service.

Guy E. Tripp, heretofore chairman of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed by the War Department as chief of the Production Division of the Ordnance Department, intrusted with the task of supervising and stimulating the production of all ordnance supplies. The appointment of Mr. Tripp is one of the important steps in the reorganization of the Ordnance Department, announced recently by its chief,



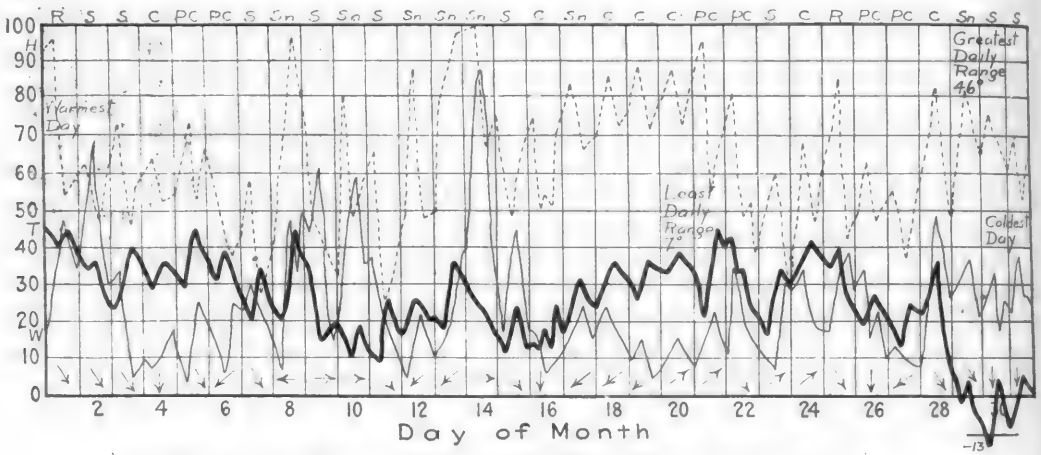
COLONEL GUY E. TRIPP
Chief of Production Division, Ordnance Department.

General Crozier. Mr. Tripp was selected because of his experience in the manufacture of munitions of all kinds, the Westinghouse company having filled large contracts from the British and Russian governments immedately on the outbreak of the European War. Mr. Tripp is credited with bringing to the department the highest obtainable type of experience and ability to insure speedy and careful production of munitions. The board of directors of the Westinghouse company has given him a leave of absence for the duration of the war.

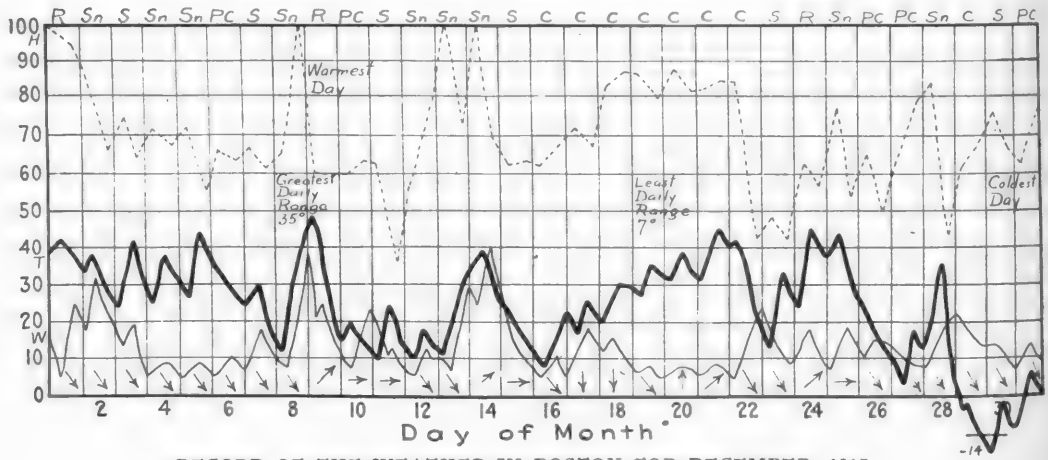
H. H. Hegeman, formerly of the Chicago office of the Kelly & Jones Co., Pittsburgh, has received his commission as second lieutenant in the regular army after completing his course at the last officers' training camp at Fort Sheridan. He is now stationed at one of the southern cantonments and is attached to the infantry branch of the regulars.

The Weather for December 1917

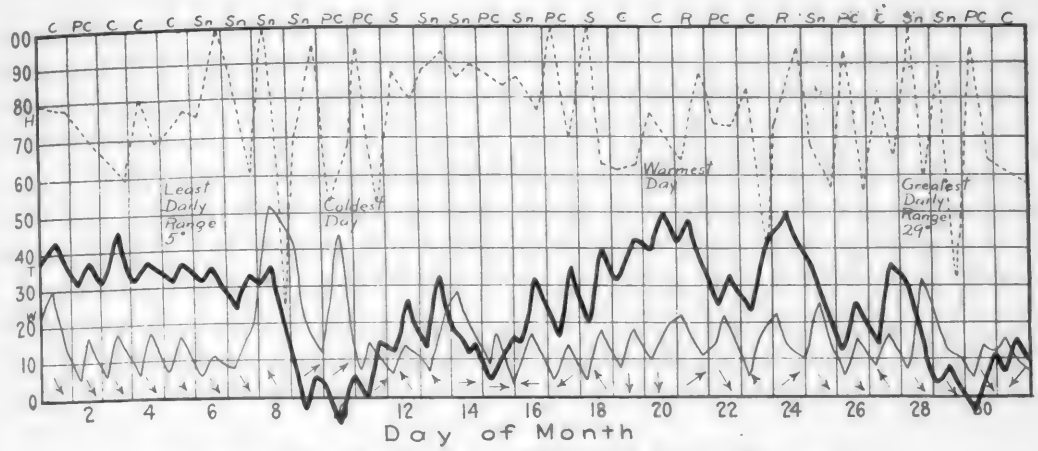
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	46	48	50	52	66
Date of highest temperature	1	9	20	20	2
Lowest temperature, degrees F.	—13	—14	—5	—3	—4
Date of lowest temperature	30	30	10	10	10
Greatest daily range, degrees F.	28	35	29	28	25
Date of greatest daily range	29	8	28	24	24
Least daily range, degrees F.	7	7	5	6	8
Date of least daily range	20	19	5	2	14
Normal temp. for month, degrees F.	25	24	24	22.4	26.8
Normal mean temp. for month, deg. F.	34.4	31.6	34.7	29.3	35.5
Total rainfall, in.	3.70	2.56	1.19	0.88	0.78
Total snowfall, in.	11.7	7	11.8	9	7.5
Normal precipitation, this month, in.	3.45	3.41	2.73	2.08	2.23
Total wind movement, miles	14521	9148	8195	9499	9494
Average hourly wind velocity, miles	19.5	12.3	11	12.8	12.8
Prevailing direction of wind	N.W.	N.W.	N.W.	N.W.	S.
Number of clear days	10	6	2	5	5
Number of partly cloudy days	7	8	10	12	1
Number of cloudy days	14	17	19	14	15
Number of days on which rain fell	9	3	3	1	5
Number of days on which snow fell	7	9	10	12	9
Snow on ground at end of month, in.	1.7	0.3	1.8	1	1.3



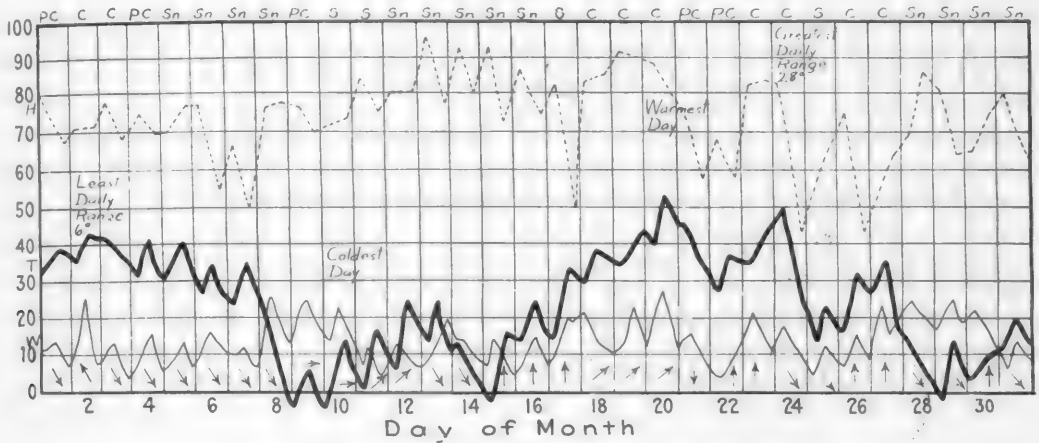
RECORD OF THE WEATHER IN NEW YORK FOR DECEMBER, 1917.
(Hourly Observations of the Relative Humidity are Plotted on this Chart.)



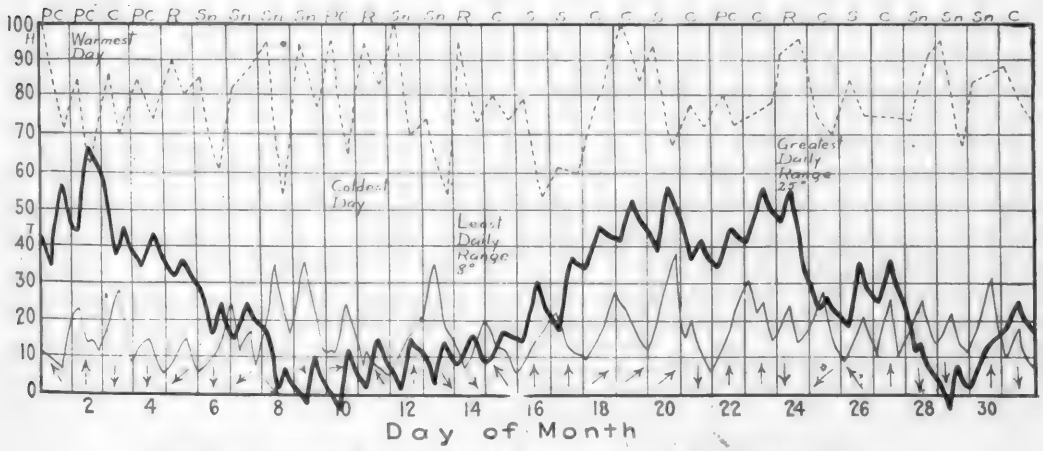
RECORD OF THE WEATHER IN BOSTON FOR DECEMBER, 1917.



RECORD OF THE WEATHER IN PITTSBURGH FOR DECEMBER, 1917.



RECORD OF THE WEATHER IN CHICAGO FOR DECEMBER, 1917.



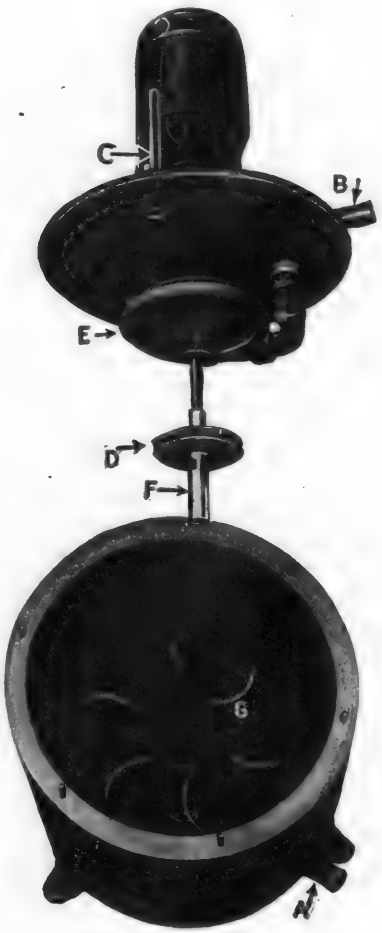
RECORD OF THE WEATHER IN ST. LOUIS FOR DECEMBER, 1917.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

New Type of Vacuum Pump

It has long been the aim of vacuum pump manufacturers to get as far away as possible from complicated features of design and to eliminate all gears, valves, plungers, pulleys, belts, separating mechanism or intermediate connections that were not essential. A step further in this direction has been taken by the Chicago Pump Co., Chicago, Ill., in its design of the Chicago turbine vacuum pump which the company has recently placed on the market.

As indicated by the accompanying illustration the vacuum pumping outfit consists of a cast-iron receiver with two impellers on one shaft, directly connected and driven by one electric motor. One impeller draws the air and water from the heating system, while the second impeller discharges the condensation water directly into the boiler. There is no other mechanism in the equipment.



NEW TYPE OF CHICAGO VACUUM PUMP.

The same equipment is used for air line vacuum heating where the air is withdrawn from the heating system. The air line pump is similar in construction to the return line vacuum pump, with the exception that it embodies only one air impeller, as it does not have to discharge water into the boiler. A difficulty sometimes experienced with air line pumps is that an unavoidable slug of water coming from heating system may stall the air line pump, but since the Chicago turbine air line pump depends upon water to help it maintain a vacuum, no amount of water interferes with its operation. If too much water returns from the heating system, it overflows through an overflow provided for that purpose.

When in operation on a return-line system, the air impeller D revolves in the center of the water brakes G which are stationary. The centrifugal force imparted to the water by the air impeller and the constant breaking up of the water by the water brakes, creates a suction or vacuum in the center of the air impeller, which in turn creates a vacuum on the return line A, through suction inlet F, which connects to return line A. The air and water drawn through this impeller accumulate in the receiver and, when the water level reaches the centrifugal water pump E, which is located a few inches above the air impeller, it is discharged into the boiler through discharge pipe B. The air is exhausted to atmosphere through vent C.

The ratio of air to water of this type of pump is 8 to 1 at 8 in. of vacuum, while, at a vacuum of 3 in., it is 25 to 1. Therefore, at an average vacuum of 5 in. and when pumping the rated or required amount of water, this pump will have a ratio of about 16 cu. ft. of air to 1 cu. ft. of water.

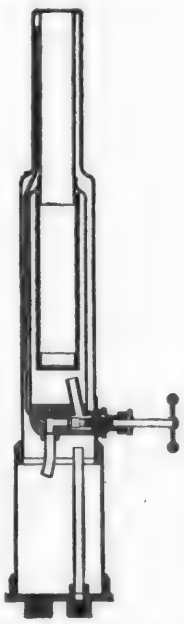
The manufacturer emphasizes the fact that this pump separates the air and water in the receiver, so that no other air eliminating or separating tanks are required, the air being exhausted to the atmosphere and the water only pumped against actual boiler pressure.

Demand for Double-Pipe Type of Air Moisteners.

The increasingly persistent demand for air moisteners that may be used with some of the various types of steam systems has made it necessary for The Air Moistener Co., of Chicago, Ill., to make its Nos. 2, 3 and 4 sizes of moisteners in the double-pipe type. This development has been in response to the demand for vacuum or

molulated pressure systems. In both of these systems the branch feeding the radiator is often of such small size and so pitched that the condensation in it will not drain back to the riser, but is carried forward by the velocity of the flowing steam into the radiator, finding an exit by way of the return pipe, with the other condensation.

This condition, of course, does no harm, as far as the heating function is concerned, but if air moisteners were attached to



DOUBLE-PIPE TYPE OF STEAM AIR MOISTENER.

branches under such conditions, condensation in the branch pipe and in the jacket surrounding the moistener, when the radiator was shut off, would be carried into the air moistener and discharged from it, together with the steam.

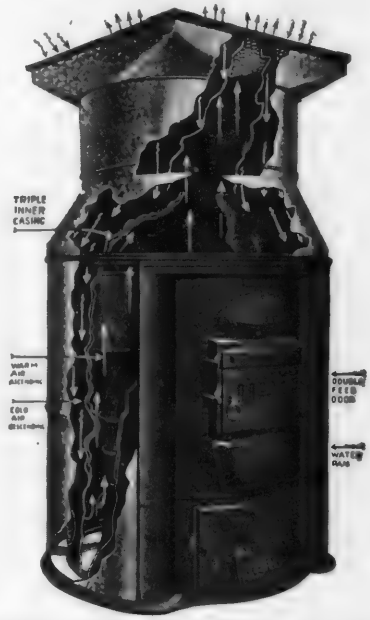
It was therefore necessary to provide the moistener with a drain of its own. To this end the makers now produce the small sizes of moisteners in the double-pipe type. As shown in the illustration, the moistener is provided with a separate supply and return which enter and lead from the bottom of the separator chamber, constituting the lower part of the moistener. Any condensation occurring in the inlet connection, or carried into it by the flowing steam, is deposited in this separator chamber, where it together with the condensation occurring in the jacket of the moistener, are led away by the return pipe, leaving only dry vapor to be discharged from the moistener.

The return connection of the moistener leads to a special, small thermostatic trap which discharges the water of condensation to the return line of the heating system. Thus the air moistener is connected in the same manner as a radiator of the vacuum system.

With the vacuum system, the condensation is discharged to the return line of the heating system, which is below atmospheric pressure. With the modulated pressure systems the return is at or very near atmosphere, but the feed line somewhat above atmosphere, so there is always an incentive for the condensation to flow from the moistener to the return side of the system. Vacuum systems which are operated at atmosphere pressure, or below, on the feed side will not of course discharge moisture to the air. It is necessary to raise the pressure to one or two pounds, at the same time raising the pressure on the return line in proportion, or, in other words, decrease the vacuum. This is so that the pressure differential at the radiator traps will remain the same.

Trade Literature.

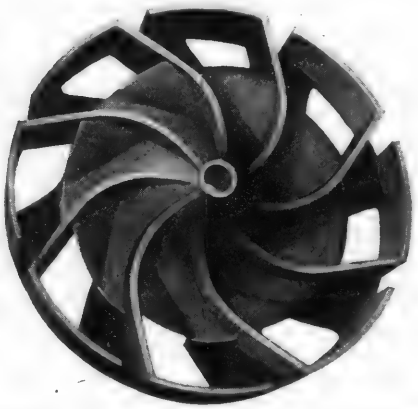
INTERNATIONAL ONE-PIPE HEATERS are featured in a catalogue issued by the International Heater Co., Utica, N. Y., and entirely devoted to this type of warm-air furnace. As its name implies, the heater uses only one large register which, however, is divided into two parts. The central por-



INTERNATIONAL ONE-PIPE HEATER

tion of the register carries up the heated air while the outer portion of the same register serves as an intake for the indoor air as it cools, thus providing a recirculating feature. As the space between the outer and inner casings is always filled with cool air returning to be heated, this type of furnace, it is claimed, will not heat the cellar. International one-pipe heaters are made in six sizes designed to warm from 4 to 14 ordinary-sized rooms. The special register furnished is finished in oxidized copper, of plain lattice design.

A No-Tank Vacuum Cleaner is the way the Connersville centrifugal vacuum cleaner is designated in recent circular matter issued by the United Vacuum Appliance Co., Connersville, Ind. It is described as radically different in construction and operation from all other designs. It may be used not only for removing dust from dry surfaces, but also to suck up soap suds and



ROTOR USED WITH NO-TANK VACUUM CLEANER.

dirty water from carpets and rugs after they have been scoured. It is also adapted to drying floors of cement, tile or linoleum, after they have been scrubbed. This scrubbing is often accomplished by the use of an electric rotary scrubbing brush. Nothing but clean air passes through the vacuum pump, as all the refuse is continuously discharged into the sewer by the flutted rotor, under no pressure. This centrifugal separation of the air and refuse, together with their automatic discharge, is accomplished without tanks, box, screens, or buckets. The rotor shown in the accompanying illustration is responsible for the separation of the dirt and air.

Hydro Gas Meters, made by the Bacharach Industrial Instrument Co., Pittsburgh, Pa., are described in a new catalogue (E), issued by this company. First is given a review of the various methods employed for measuring gases, such as impact and Pitot tubes, orifices, nozzles, venturi tubes, etc., cuts being used to illustrate these methods. It is pointed out that in each of these devices, the differential pressure is the quantity to be measured, and then follows a description of the Hydro instrument which measures and records this differential pressure. By varying the proportions of the instrument, any desired magnification of the differential pressure can be obtained.

Applications of the Hydro volume meter to blast furnaces, producer plants, etc., are given, as well as measuring air for mine and building ventilation. The instrument is also made portable for use of the testing engineer and the efficiency expert.

How Anyone Can Make a Jointless, Gas-Tight Furnace Lining is told in a 16-page illustrated folder received from the Betson Plastic Fire Brick Co., Rome, N. Y. The folder shows how the "plastic fire brick" made by this company is used in forming one-piece linings for steam boiler furnaces. The old lining of firebricks or blocks is first removed and the plastic material is then placed in the form of chunks, consolidated with a mallet and smoothed with a trowel, occupying the same thickness as the old lining. The special mechanical process used in the preparation of this material is said to eliminate expansion and contraction with temperature changes. After the material has been dried and set by a slow fire for four or five hours, the furnace can be put into full service. No molds or special forms are used. The same material is used for forming baffles in water-tube boilers.

Industrial Electric Heating Apparatus, carrying the entire product in this line of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is presented to the trade in a new catalogue (8-E.). The line includes steel-clad heaters for many industrial processs, immersion-type water heaters, etc. Data are given for calculating the proper amount of heating to provide for water and for the heating of buildings. Westinghouse electric heaters, which are of the ribbon type, are described and also the company's system of thermostatic control. The catalogue should prove of value to any man whose work includes the application of heat at moderate temperatures for industrial purposes.

SUPPLY AND EXHAUST OUTLETS.

While there are many different methods of making flue connections to supply and exhaust outlets, the simplest satisfactory connections are shown in Figs. 1 and 2.

In Fig. 1 is illustrated an up-feed supply system outlet in which the vertical flue is carried a slight distance above the top of the outlet in order to form an air cushion and to help equalize the air flow across the register face. This distance—which is usually made 8 in. to 12 in.—does not absolutely equalize the air flow but tends to prevent such a large quantity of air shooting out through the top third of the register as would be the case if a plain elbow were used.

The volume damper is an ordinary wing damper one end of which is attached to a wire held by the set screw. It is necessary to have the register face either hinged or to set the volume dampers before the

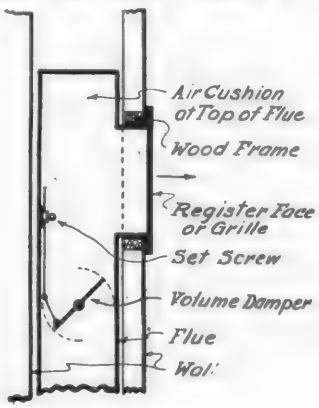


FIG. 1

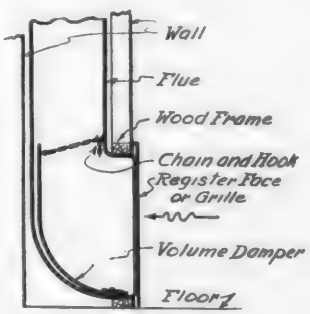


FIG. 2.

installation of the registers. Many engineers prefer their volume dampers set at other points in the duct system to avoid this difficulty, but it must be admitted that an outlet can be set more quickly from anemometer readings when the damper is at the outlet than when it is off in some other part of the building.

Fig. 2 illustrates a similar outlet for an up-feed exhaust system with a volume damper consisting of a piece of curved sheet metal riveted to the flue at the bottom and hooked to the proper position at the top by means of the chain and hook shown. The spring of the metal will hold this damper tightly in its proper place after being adjusted. To operate this damper a hinged or removable register must be used and for this reason some engineers prefer controlling air in the flue from a damper located in the horizontal duct connecting to the top of the flue.

In all cases it has been found advantageous to have the wood frame made around the flue outlet in the shop; this protects the outlet during shipping, handling and erection, keeping it in proper shape and preventing bending and dents. After the flues are erected the wooden frames have wall ties nailed to them and are walled in; the furring strips are run around the edge and the wall plastered, after which the registers or grilles are mounted by attaching them to the metal, or by screwing through the furring into the solid wood of frame.

REVERSING DAMPERS.

In many buildings it is considered desirable to put the warm air in at the upper openings during the winter, drawing the cold air out of the lower exhaust openings at the floor, while in summer it is preferred to draw the hot air at the ceiling off through the upper openings and putting the cold air in through the lower openings. In other cases it may be desirable to use upward ventilation (supply openings low and exhaust openings high) whenever cigar smoke is to be handled, and downward ventilation (supply openings high and exhaust openings low) at all other times.

In the ordinary duct system such a reversal is impossible, but in cases where the supply and exhaust fans are set close together, or where the main supply and exhaust ducts run near each other, it is possible to provide for such conditions by the proper arrangement of one or more dampers.

The single reversing damper is shown in Fig. 1, the duct E being connected to the suction opening of the exhaust fan, the duct S to the discharge

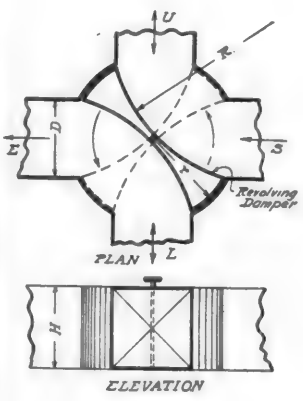


FIG. 1.

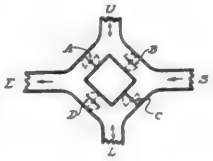


FIG. 2.

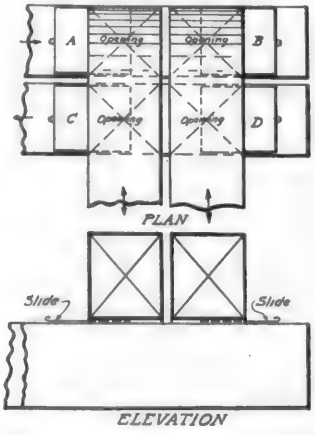


FIG. 3.

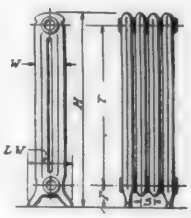
opening of the supply fan, the duct U to the upper openings in the building and the duct L to the lower openings in the building. It is self-evident that the turning of the damper from the position shown in full lines to the position shown in dotted lines will reverse the flow of air in both the ducts U and L. The ducts coming into such a damper must all be of the same size and dimensions, the height H of the damper being the same as the height of the duct. The radius of the damper casing r is equal to the width of the duct D, plus a few inches (to allow for the construction in the middle of the damper). The damper radius R is equal to 2r or twice that of the casing.

A second method, where the ducts are not on the same level, is shown in Fig. 2. Here the opening of slides A and D closing B and C or the opening B and C and the closing of A and D will reverse the flow in the ducts U and L.

A third method is shown in Fig. 3, where the opening of dampers A and C and the closing of B and D will reverse the flow in ducts U and L from what it would be with B and D open and A and C closed.

AMERICAN RADIATOR COMPANY'S ROCOCO TWO-COLUMN RADIATORS FOR STEAM AND WATER

No. of Sections	* Length 2⅜ in. per Sec.	Heating Surface — Square Feet: 45-in. Height 5 sq. ft. per Sec.	38-in. Height 4 sq. ft. per Sec.	32-in. Height 3½ sq. ft. per Sec.	26-in. Height 2¾ sq. ft. per Sec.	23-in. Height 2½ sq. ft. per Sec.	20-in. Height 2 sq. ft. per Sec.
2	5	10	8	6⅞	5⅛	4⅝	4
3	7½	15	12	10	8	7	6
4	10	20	16	13⅛	10⅜	9⅛	8
5	12½	25	20	16⅜	13⅛	11⅜	10
6	15	30	24	20	16	14	12
7	17½	35	28	23⅛	18⅜	16⅛	14
8	20	40	32	26⅝	21⅛	18⅜	16
9	22½	45	36	30	24	21	18
10	25	50	40	33⅛	26⅜	23⅛	20
11	27½	55	44	36⅝	29⅛	25⅜	22
12	30	60	48	40	32	28	24
13	32½	65	52	43⅛	34⅜	30⅛	26
14	35	70	56	46⅝	37⅛	32⅜	28
15	37½	75	60	50	40	35	30
16	40	80	64	53⅛	42⅜	37⅛	32
17	42½	85	68	56⅜	45⅛	39⅜	34
18	45	90	72	60	48	42	36
19	47½	95	76	63⅛	50⅜	44⅛	38
20	50	100	80	66⅜	53⅛	46⅜	40
21	52½	105	84	70	56	49	42
22	55	110	88	73⅛	58⅜	51⅛	44
23	57½	115	92	76⅜	61⅛	53⅜	46
24	60	120	96	80	64	56	48
25	62½	125	100	83⅛	66⅜	58⅛	50
26	65	130	104	86⅜	69⅛	60⅜	52
27	67½	135	108	90	72	63	54
28	70	140	112	93⅛	74⅜	65⅛	56
29	72½	145	116	96⅜	77⅛	67⅜	58
30	75	150	120	100	80	70	60
31	77½	155	124	103⅛	82⅜	72⅛	62
32	80	160	128	106⅜	85⅛	74⅜	64



Connections: WATER—Extra-heavy right and left-threaded nipples top and bottom. STEAM—Extra-heavy right-threaded nipples at bottom only and with right and left-threaded nipples at bottom only.

Low Drip Hubs: ONE-PIPE STEAM—on supply leg-section; TWO-PIPE STEAM—on return leg-section.

* Add ½ in. to length for each bushing.

DIMENSIONS

H = Total overall height.
T = C. to C. of tappings.
F = Floor to center of bottom tapping.
W = Width of Radiator—7⅜ in.
LW = Width of Radiator Legs—8 3/16 in.
S = Width of Radiator Sections—*i.e.*, c. to c. of sections or 2½ in.

Nominal Height of Radiator	45-in.	38-in.	32-in.	26-in.	23-in.	20-in.
H	45 25/64	37 45/64	31 53/64	26 5/64	23 11/64	20 1/4
T	38 25/32	31 3/32	25 13/32	19 15/32	16 9/16	13 41/64

Note: For legless radiators deduct 3 in. from H.
For high legs add 2 in. and for extra high 4 in. to H. and F.
On 45-in. radiators high legs and extra high legs are special.

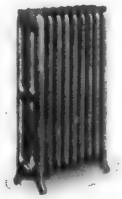
TAPPING DATA

All radiators are tapped 2 in. and bushed as follows:

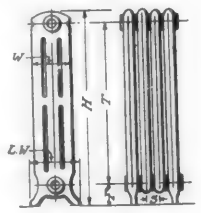
SYSTEM	Size of Radiator, Square Feet	Supply In.	Supply Diam.	F In.	Return In.	Return Diam.	F In.
Steam, one-pipe	Up to 24 inc.		1	4	..	..	..
	Over 24 up to 60 inc.		1¼	4	..	..	..
	Over 60 up to 100 inc.		1½	4	..	..	..
	Over 100		2	4	..	..	..
Steam, two-pipe	Up to 48 inc.		1	4½	¾		4
	Over 48 up to 96 inc.		1¼	4½	1		4
	Over 96		1½	4½	1¼		4
Water	Up to 40 inc.		1	4	1		4
	Over 40 up to 72 inc.		1¼	4	1¼		4
	Over 72		1¼	4	1½		4

Air valve tappings are ⅛ in.
Vapor tappings, top and bottom, opposite ends ¾ in. supply and ½ in. return.
All tappings with right-hand threads unless otherwise ordered.

AMERICAN RADIATOR COMPANY'S ROCOCO THREE-COLUMN RADIATORS FOR STEAM AND WATER



No. of Sections	* Length 2⅛ in. per Sec.	Heating Surface — Square Feet: 45-in Height 6 sq. ft per Sec	38-in Height 5 sq. ft per Sec	32-in Height 4½ sq. ft per Sec	26-in Height 3⅜ sq. ft per Sec	22-in. Height 3 sq. ft. per Sec.	18-in Height 2½ sq. ft per Sec
2	5	12	10	9	7½	6	4½
3	7⅛	18	15	13½	11¼	9	6¾
4	10	24	20	18	15	12	9
5	12⅝	30	25	22½	18¾	15	11¼
6	15	36	30	27	22½	18	13½
7	17⅛	42	35	31½	26¼	21	15¾
8	20	48	40	36	30	24	18
9	22½	54	45	40½	33¾	27	20¼
10	25	60	50	45	37½	30	22½
11	27⅛	66	55	49½	41¼	33	24¾
12	30	72	60	54	45	36	27
13	32⅝	78	65	58½	48¾	39	29¼
14	35	84	70	63	52½	42	31½
15	37½	90	75	67½	56¼	45	33¾
16	40	96	80	72	60	48	36
17	42⅛	102	85	76½	63¾	51	38¼
18	45	108	90	81	67½	54	40½
19	47½	114	95	85½	71¼	57	42¾
20	50	120	100	90	75	60	45
21	52½	126	105	94½	78¾	63	47¼
22	55	132	110	99	82½	66	49½
23	57½	138	115	103½	86¼	69	51¾
24	60	144	120	108	90	72	54
25	62½	150	125	112½	93¾	75	56¼
26	65	156	130	117	97½	78	58½
27	67½	162	135	121½	101¼	81	60¾
28	70	168	140	126	105	84	63
29	72½	174	145	130½	108¾	87	65¼
30	75	180	150	135	112½	90	67½
31	77½	186	155	139½	116¼	93	69¾
32	80	192	160	144	120	96	72



Connections: WATER—extra-heavy right and left-threaded nipples at top and bottom. STEAM—with extra-heavy right-threaded nipples at bottom only and with right and left-threaded nipples at bottom only.

Low Drip Hubs: ONE-PIPE STEAM—on supply leg-section; TWO-PIPE STEAM—on return leg-section.

* Add ½ in. to length for each bushing.

DIMENSIONS

H = Total overall height.
T = C. to C. of tappings on water radiators.
F = Floor to center of bottom tapping.
W = Width of radiator—9 in.
LW = Width of radiator legs—9⅞ in.
S = Width of Radiator Sections—*i.e.*, c. to c. of sections or 2½ in.

Nominal Height of Radiator	45-in.	38-in.	32-in.	26-in.	22-in.	18-in.
H	45 15/16	38 11/32	32 11/32	26 19/32	22 11/32	18 5/16
T	38 25/32	31 3/32	25 13/64	19 15/32	15 7/32	11 3/16

Note: For legless radiators deduct 3 in. from H.
For high legs add 2 in. and for extra high 4 in. to H and F.
On 45 in. radiators high legs and extra high legs are special.

TAPPING DATA

All radiators are tapped 2 in. and bushed as follows:

SYSTEM	Size of Radiator, Square Feet	Supply In. Diam.	F In.	Return In. Diam.	F In.
Steam, one-pipe	Up to 24 inc.	1	4	..	..
	Over 24 up to 60 inc.	1¼	4	..	..
	Over 60 up to 100 inc.	1½	4	..	..
	Over 100	2	4	..	..
Steam, two-pipe	Up to 48 inc.	1	4½	¾	4
	Over 48 up to 96 inc.	1¼	4½	1	4
	Over 96	1½	4½	1¼	4
Water	Up to 40 inc.	1	4	1	4
	Over 40 up to 72 inc.	1¼	4	1¼	4
	Over 72	1½	4	1½	4

Air valve tappings are ⅛ in.
Vapor tappings, top and bottom, opposite ends ¾ in. supply and ½ in. return.
All tappings with right-hand threads unless otherwise ordered.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

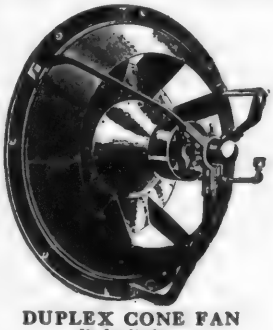
Chicago, Ill.—An order has been issued by the Cook County Fuel Administration Committee which states that "as a conservation measure for the purpose of relieving the present coal shortage and indirectly to assist in relieving the congested condition of the railroads, all users in Cook County, Ill., of fuel for heating purposes in hotels, office buildings, stores, shops, theatres, factories, apartment buildings, flats, residences, and all other structures, are hereby directed to maintain in all such buildings, structures, and places, a temperature of not to exceed seventy degrees, except on specific orders from a physician where, in special instances, it is necessary to maintain a higher temperature." The order, unless withdrawn, continues in effect until April 1, 1918. Placards announcing the fuel administration committee's order have been distributed by the Building Managers' Association, in which the following additional rules are given: Turn off radiators in all rooms not in actual use; ventilate properly but do not waste heat—waste of heat is waste of fuel; turn out lights not in use; do not waste hot water—every gallon wasted wastes so much fuel.

Bozeman, Mont.—A central heating plant for the State Tuberculosis Sanitorium at Galena, Mont., is under consideration. Fred F. Wilson, of Bozeman, is the architect.

Albert W. Clegg, of F. A. Clegg & Co., Louisville, Ky., heating and ventilating contractors, was married December 24, to Miss Mary Seiler, of Louisville. Mr. Clegg is now at Camp Joseph H. Johnson, Jacksonville, Fla., in training for a commission in the Quartermaster's Reserve Corps.

Frank B. Howell, assistant general manager of sales of the American Radiator Company, with headquarters in Buffalo, is recuperating from an attack of pneumonia.

A. C. Edgar, for many years manager of



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the boiler department of the Abram Cox Stove Co., Philadelphia, Pa., is acting as technical expert for the United States Shipping Board Emergency Fleet Corporation, with headquarters in the Commercial Trust Building, Philadelphia. Mr. Edgar will divide his time between the Hog Island, Bristol and Newark shipbuilding plants.

National Pipe & Supplies Association will hold its ninth annual convention in Cleveland, O., May 13 and 14, 1918. Headquarters will be at the Hollenden Hotel. On the three days following this convention, May 15-17, a triple convention will be held of the National Supply & Machinery Dealers' Association, the Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers' Association.

Professor John R. Allen, of the University of Minnesota, was in Washington recently attending a conference in connection with his work in the Signal Service Department of the army.

Fort Wayne, Ind.—The expansion of the General Electric Company's plant and the increased demands upon the steam and water systems has created the need for more attention to that portion of the plant. A new office is the result, O. C. Fink having been appointed supervisor of the steam and water system. His duties will be to see that the facilities in his department are utilized to good advantage and that no damage results from want of heat, such as freezing of pipes and too low temperatures in the offices and shops where men and women work.

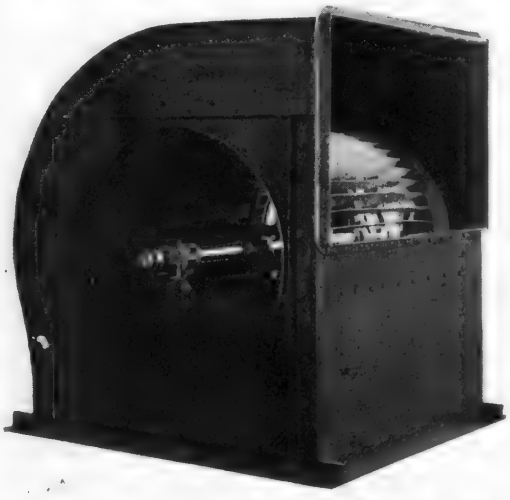
Central Supply Association will hold its regular winter meeting in Chicago, February 20, at the Auditorium Hotel. An address will be given by an expert on "Depreciation, Co-Insurance and Tax Reports."

Manufacturers' Notes.

D. T. Williams Valve Co., Cincinnati, O., has purchased the plant of the Queen City Brass & Iron Co., of that city, which will be used to give additional capacity for the D. T. Williams Valve Co. The deal, it is stated, involved an amount approximating $300,000. The capital stock of the D. T. Williams Valve Company will be increased from $175,000 to $750,000, all of which will be absorbed by the present stockholders.

Moline Heat, Moline, Ill., announces that

Watch for Our Announcement



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George P. Smith, for the past four years manager of the heating department of the Mine & Smelter Supply Co., Salt Lake City, Utah, has been appointed sales representative for Moline Heat, covering Utah, part of Nevada, Wyoming and Idaho. Mr. Smith will make his headquarters at 202 Dooly Building, Salt Lake City.

Lavigne Mfg. Co., Detroit, Mich., announces that the company's name has been changed to the Commonwealth Brass Corporation. The management has long held the idea that the former name was not truly representative of the activities of the company and therefore has selected a title more closely identified with the brass industry. There will be no change in the description, quality or type of goods produced by the corporation under its new name and the personnel remains the same as before, namley: President, P. D. Dwight; vice-president and general manager, N. A. Henwood; secretary and treasurer, Carl L. Brumme; superintendent, C. S. Kellum. It is further announced that J. P. Lavigne, at one time connected with the Lavigne Mfg. Co., is not associated with the Commonwealth Brass Corporation.

Bishop-Babcock-Becker Co., Cleveland, O., has secured control of the Consolidated Engineering Co., Chicago, Ill., manufacturer of the Van Auken system of vacuum heating, Kinealy air washers and the Thermograde modulation system of heating, as well as of the Massachusetts fans, with plants in Chicago and Watertown, Mass. The Bishop-Babcock-Becker Company is preparing plans for a new manufacturing plant to be built on a site the company has purchased at Bliss Road and the Nickel Plate Railroad, near Cleveland.

Crane Co., Chicago, Ill., distributed approximately $1,200,000 to its employees at Christmas time, being 10% of the earnings of each employee. About 12,000 employees shared in this distribution. The company also presented to each employee a book of war savings stamps partially filled.

Union Radiator Co., Johnstown, Pa., announces that William Speakman, formerly manager of the company's Pittsburgh branch, has been placed in charge of the company's Philadelphia office, at 106 North 17th Street.

Ohio Blower Co., Cleveland O., held a convention of its salesmen at the Winton Hotel, Cleveland, January 3-5 last.

Sprague Electric Works, New York, has

CHICAGO TURBINE VACUUM PUMPS

For Maintaining a Constant Vacuum and Returning Condensation Directly to Boiler

SIMPLE - DURABLE - POSITIVE

One air and one water impeller are mounted on one shaft in cast-iron receiver and driven by one motor. Air and water return at bottom of receiver, the air is exhausted to atmosphere, and water discharged to boiler. The receiver has a low water level.

AIR LINE VACUUM PUMPS

FOR USE ON AIR LINE HEATING SYSTEMS

are even simpler than Vacuum Pump. Take up little space. Run quietly and will not be affected by any amount of water. We can make quick delivery.

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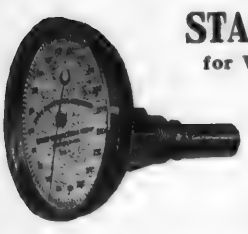
Manufacturers of BILGE, CONDENSATION, MULTI-STAGE, TURBINE, HOUSE, CIRCULATING and BOILER FEED PUMPS and SEWAGE EJECTORS



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for VACUUM, STEAM and HOT WATER SYSTEMS, BAKE OVENS and COLD STORAGE PLANTS. SEVEN models of RECORDING and EIGHT of INDICATING Thermometers. All Accurate, Durable and Legible,

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They are practically indestructible, are sensitive to changing temperatures and are very easily installed. Supplied with horizontal or vertical extension and standard pipe thread.

Ask for catalog No. 100-107 and trade prices.

STANDARD THERMOMETER COMPANY, 65 Shirley St., Boston, Mass.

appointed Frank W. Hall as commercial manager of the company. With the exception of a short period, Mr. Hall has been connected with the Sprague Electric Works continuously for 22 years in various engineering and sales capacities, and for three years prior to his present appointment occupied the position of sales manager. D. C. Durland, former executive head of the Sprague Electric Works, has resigned to accept the presidency of the Mitchell Motor Co., Inc.

Skinner Bros. Mfg. Co., St. Louis, Mo., manufacturers of the Baetz patent air heaters announces that its recent orders include 13 heaters for the Newport News Shipbuilding & Dry Dock Co., 12 heaters for the American Car & Foundry Co., for its shops in Depew, near Buffalo; 11 heaters for the Berger Mfg. Co., Canton, O.; and 10 heaters for the Holt Mfg. Co., Peoria, Ill.

Lennox Furnace Co., Marshalltown, Ia., has increased its capital common stock from $250,000 to $400,000. The company already has an authorized issue of $100,000 7% preferred stock.

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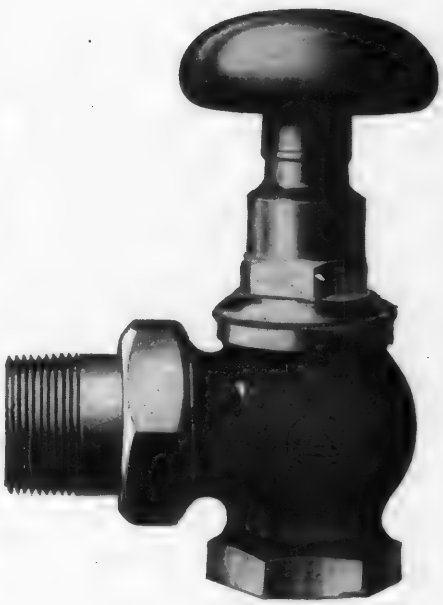
DETROIT PACKLESS RADIATOR VALVES



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LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

Single Pipe Type

Steamo and Vapo Air Moisteners

An Air Moistener for Every Service

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Central Station Heating Notes.

Casper, Wyo.—Fire of suspected incendiary origin destroyed the plant of the Natrona Power Company January 4, shutting off heat and electric light supplied to the business section of the city. The amount of the damage will total $150,000.

Lansing, Mich.—At a deferred meeting of the combined council and citizens' committee appointed to fix the monthly rate to be charged by the Michigan Power Company, it was decided to maintain a rate of 70 and 75 cents per 1000 lbs. of condensation for steam heat throughout the winter.

Frankfort, Ky.—The Court of Appeals at Frankfort, has dismissed the appeal of the Kentucky Heating Company, one of the constituent companies of the Louisville Gas & Electric Company, from judgment of the Jefferson Circuit Court in the suit of the city of Louisville to enjoin the company from using the streets for its pipes. The lower court held that the heating company's franchise expired in 1908, but reserved the case for adjudication of damages for using the streets from 1908 to 1913. The Court of Appeals ruled that the judgment was not final and, therefore, not appealable.

Johnson { Heat / Humidity } Control

Always the Leader in Inventions and Improvements

First: Practical Heat Regulation.

Second: Pneumatic Thermostats.

Third: Humidostats—the first practical apparatus for the control of humidity.

Fourth: The "SYLPHON" Metal Diaphragm Valve for heat control, the one thing needed to make heat regulating systems durable and reliable. We tested this valve three years before we offered it for use. Untested imitations and substitutes followed fast, but having been thoroughly tested and proven equal to all demands,
the "SYLPHON" is the Recognized Standard.

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Johnson Service Company

Milwaukee, Wis.
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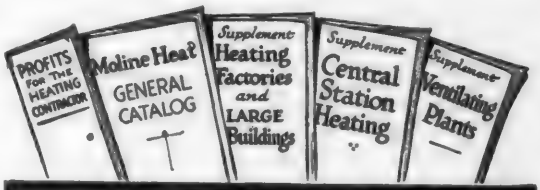
Anderson, Ind.—According to a ruling made by E. I. Lewis, chairman of the Indiana Public Service Commission, a central heating company may not discontinue its heating service without obtaining permission from the commission. The ruling was made in connection with the action of the Central Heating Co., of Anderson, which cut off its steam heating service from the business section of that city and from parts of the residential section. It seems that the company notified its patrons some time ago that it would have to discontinue the heating service unless the citizens refrained from burning gas as a substitute for steam heat. Some of the users of central station heat claim that in zero weather it is not possible to heat their homes to the required temperatures without supplementing their steam heat with gas heaters.

Frankfort, Ind.—Declaring that "what amounts to a fraud upon this commission and an injustice to its patrons" has been perpetrated, the Indiana Public Service Commission has issued an order reducing the revenues of the Franfort Heating Company. In the order, which was written by Commissioner Edwin Corr, it is stated that some time ago the heating company upon a proper showing, was granted an increase of rates, later a surcharge and then, when the new charges were effective,



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Each one is worth big money to you. Every heating contractor should have them. They cover all the latest money-making ideas in figuring and installing steam heat—hot water heat—vapor heat—and vacuum systems.

These books will help you to land more orders and increase your profit on every job. Write for them at once. They are absolutely *FREE!*

Moline Illinois

JOHNS-MANVILLE RADIATOR TRAP

Just a ball—that's all

OFTEN it's the smallest fitting that kicks up the most trouble. Either it's hard to connect up, or the adjustment is delicate. Or some little part keeps wearing out. And, on jobs where the margin is small, these little troubles play hop with profits.

So it will pay you to get acquainted with the Johns-Manville Radiator Trap—because it's the simplest on the market. Just three parts—body, ball and connecting union; only one moving part—the hollow ball. It regulates itself, no nice adjustments necessary, no chance of tampering. You'll find this trap a money-saver all along the line.

Supplied for straight or angle connections—right, left or bottom outlet. Pamphlet and prices on application.

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NEW YORK CITY

10 Factories—Branches in 61 large cities

the company proceeded to increase the basis for determining the monthly bills. The company, the commissioner adds, was found to be in a fair way to receive "$8,000 a year in excess of a reasonable earning." The commission's order now requires that the heating company "charge its customers for the heating year of 1917-1918 on the basis of the number of square feet of radiation actually installed and to desist from making said charges on any other basis." A part of the order follows:

"This commission authorized the Frankfort Heating Company to increase its rates for hot water heating at Frankfort, Ind., from 17 cents to 20½ cents per square foot of radiation.

"This commission authorized also a surcharge for the heating year of 1917 and 1918 of 2 cents per square foot of radiation.

"The increases were allowed on the representation of the petitioner that the number of square feet of radiation supplied with heat by it was in round numbers 200,000. An audit of the books shows the radiation in the years of 1915 and 1916 was 205,910 sq. ft.

"It developed in the evidence at the hearing that petitioner was not using as a basis of its charges for the year 1917 and 1918 the actual radiation installed in connection with its plant, but that it was using an estimated radiation for such charges amounting to 247,000 sq. ft.

"This representation by this company that its radiation was 200,000 sq. ft. upon which basis it secured an increase in rates, should be binding on said company. The fixing of about 247,000 sq. ft. of radiation as the basis on which it is making its charges amounts to a fraud upon this commission and an injustice upon its patrons.

"Said company will be required to base its charges on the amount of radiation installed, and not on some theoretical estimate in order to increase its rates."

New Incorporations.

FarQuar Heating Co., of Northern Indiana, Kokomo, Ind., capital $10,000, to design and install heating plants. Directors: Albert J. Brown, Fred C. Kroft, John J. Hall, W. P. Silvey and William H. Harrison.

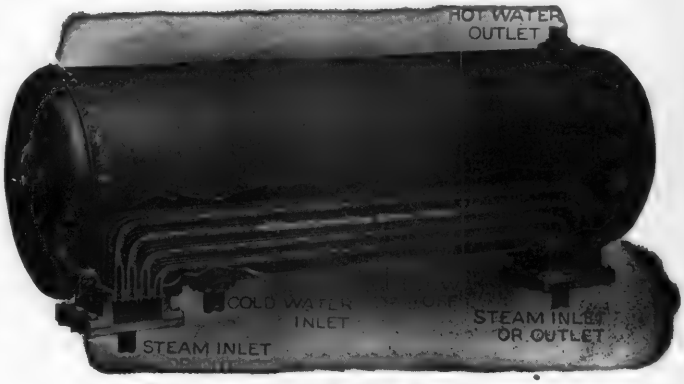
Art Metal Radiator Cover Co., Chicago, Ill., capital $5,000. Incorporators: Edward Schelicher, Irene J. Schleicher and Frederick A. Siebold, Jr.

THE ⌐¬ SHAPE TUBES EXPLAIN THE SUCCESS

of the

PATTERSON HOT WATER TANK

for heating water for domestic or manufacturing purposes. Both ends of each seamless brass tube are expanded into heavy cast-iron tube-heads with an improved roller expander. Their shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.



Type C. Patented Aug. 26, 1913.

Any Combination of Storage and Heating Capacities can be Furnished. Send for Catalogue.

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In World's Finest Newspaper Plant

Two complete units of Sirocco Air Purifying Systems are serving in the new home of the Detroit News—undoubtedly the most modern newspaper plant in existence.

The top illustration at the left shows one of the two Sirocco Fan Outfits. The lower illustration shows one of the two Sirocco Air Purifying Systems.

It was our privilege to co-operate with Architect Albert Kahn, of Detroit, and the General Contractors, George A. Fuller Co., of Detroit, in the application of this Sirocco Equipment.

Our Engineering Department is glad to co-operate with Architects, Engineers and Contractors in connection with Sirocco application.

American Blower Co.

Detroit, Michigan

Branches in all Large Cities

Canadian Sirocco Co., Ltd.
Windsor, Ont.
Manufacturers for Canada

Electric Steam Radiator Co., Chicago, Ill., capital $60,000. Incorporators: Frederick E. Ellithorpe, Gilbert Ellithorpe and William B. Lucas.

Northwestern Heating and Contracting Co., Erie, Pa., capital $10,000, to conduct a heating contracting business. President, F. W. Egan; secretary and treasurer, William F. Egan. The new company has taken quarters at 515 Commerce Building, Erie, and has purchased a large building to be used as a warehouse, shop and show-room at 1703 Sassafras street.

H. A. Norbom Mfg. Co., Philadelphia, Pa., capital $100,000, to manufacture heating specialties. Incorporators: Halfdan A. Norbom, M. J. Robinson and M. L. Maris, all of Philadelphia.

Uniform Heater Co., Chicago, Ill., capital $5,000, to manufacture heating specialties. Incorporators: A. J. Moore, W. C. Hodgins and J. G. Flint.

Drake Heating & Plumbing Co., Drake, S. D., capital $15,000. Incorporators: E. A. Hohman, John Beutler and William Beutler.

Henry Stoner Supply Co., Canton, O., capital $10,000, to deal in heating and plumbing specialties. Incorporators: G. O. Moon and G. W. Cornelius.

Business Steady at the Opening of the New Year.

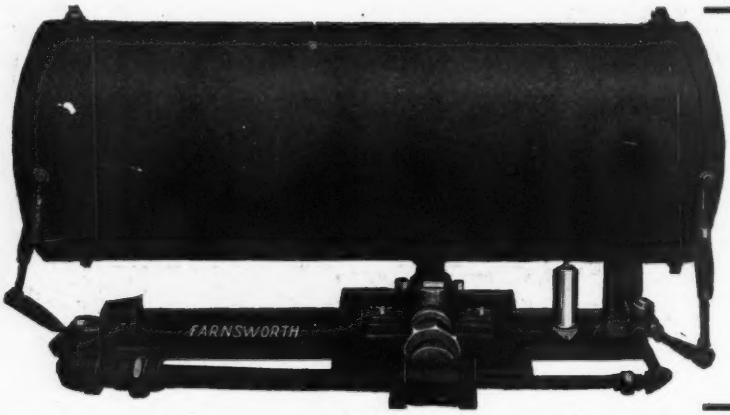
A bird's eye view of business, made public recently by the United States Chamber of Commerce, shows that extraordinary and abnormal demands made upon everyone, from farm boy to corporation head, have left the nation steady, with heavy reserves coming up for the new year. The report is made by the chamber's permanent committee of statistical experts, of which Archer Wall Douglas, of St. Louis, is chairman. Manufacturers with scarcely an exception, states the report, have all they can do, although building operations are much curtailed. The labor shortage is everywhere marked. The attitude of the business world towards the future, runs the report, seems to depend more upon local conditions than upon any general sentiment. In general, however, in the larger portion of the country, the buying power of the many is greater and more widespread than ever before.

WANTED

Wanted.—Heating and ventilating engineer to supervise design, installation and work in advisory capacity in connection with maintenance in large rubber factory in northern Ohio. Salary commensurate with training, experience, and ability to handle men. Splendid opportunity for the right man. Address Box 40, care of Heating and Ventilating Magazine.

Wanted—Heating and ventilating engineers and estimators. Apply, giving salary desired and references, to Thompson & Starrett Co., Heating Department, 660 First Ave., New York.

Wanted—Large Eastern Manufacturer of engineering specialties long established desires young man, not under 30 years, with technical education, good personality, and initiative; knowledge of heating, ventilation, and power plant engineering and installation practice essential. An excellent opportunity will be provided for development and promotion for the right man. Reply by letter giving full particulars and experience and salary expected. Replies will be treated confidentially. Address Manufacturer, care of Heating and Ventilating Magazine.



Condensation Pumps

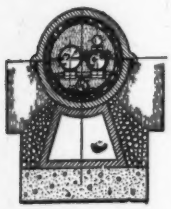
7 Types

Send for catalogue and circular showing systems

FARNSWORTH CO.
Conshohocken, Pa.

Proposal to Boycott German Business After the War.

A referendum has been submitted by the United States Chamber of Commerce to its membership, comprising 500,000 American business men, on the question of notifying the business men of Germany that they will not re-establish trade relations with Germany unless a government responsible to the people is given power. The proposed action, it is pointed out, is based on the logic that only through industrial intercourse with the United States can the military party of Germany get the sinews with which to precipitate a second great world war.



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Insulating Underground Steam and Hot Water Pipes

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Copper Diaphragm Expansion Joints, Slip Joints, Anchor Crosses, Line Anchors, Collars, Manhole-Curbs, Pipe Guides, and The Detroit Condensation Meter

THE DETROIT FEED WATER METER
Central Station Steam Co., Detroit, Mich.

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For Hotels, Apartment Buildings, Hospitals, Y. M. C. A. Buildings Schools, etc.

For Live or Exhaust Steam

requiring large quantities of hot water. This type of heater should be used in preference to circulating generator and storage tank—or instantaneous heaters.

Special attention given to all kinds of water heating problems based on long experience in this work.

Valuable tables have been prepared, showing heater capacities using steam at various pressures. These tables are yours for the asking.

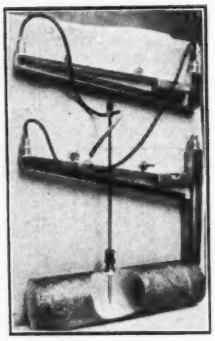
THE SIMS CO., 18th St., Erie, Pa.

Do You Know How Much Air You are Using?

A PORTABLE PITOT TUBE

Should be used to test every air line.

Easy to Use—Accurate—Inexpensive



Each instrument is individually calibrated; each tube is nickel-plated, and furnished with plush-lined box.

The stuffing-box prevents leakage of gas around the stem; the tube may be rotated or moved in and out, or it may be clamped in any position by tightening the stuffing-box nut. The stem is graduated to tenths of an inch. Suitable for all diameters of pipe up to 24 in.

Instruction sheet gives constants applying to all usual applications.

Prices and further information on application

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CONNERSVILLE VACUUM CLEANERS

None too Large
None too Small

MANUFACTURED BY

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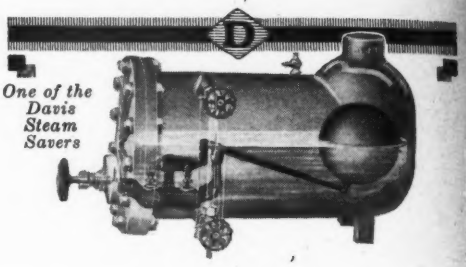

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Automatically keep steam lines free of condensation—without loss of steam.

Dry steam is essential in your plant; it is necessary to the most economical operation. But dry steam is impossible where the steam lines contain water of condensation.

Davis Steam Traps operate under any pressure, and discharge continuously against any lower pressure. They have cone shaped balanced valves that give unusually large capacity, and will not stick or clog. Valves and seats are renewable—made of Special Bronze, non-corrosive and extra hard. All working parts may be easily removed without breaking pipe connections.

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